THE ENGINEERING RECORD

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

MAIN OFFICES:
114 LIBERTY STREET, NEW YORK.
BRANCH OFFICES:
PHILADELPHIA: 929 Chestnut Street.
CHICAGO: 1140 Monadnock Block.
CLEVELAND: Cuyahoga Building.
LONDON OFFICE: Hastings House, Norfolk St., Strand.

SUBSCRIPTION RATES:

United States, Canada, Cuba and Mexico....$3.00 a year.
Foreign subscription .... 6.00 a year.
25 shillings. 25 marks. 31 francs.
Foreign subscriptions may be sent to our London office.

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Change in advertisements intended for a particular issue should reach the office of THE ENGINEERING RECORD by 10 A. M. Monday of the week of issue. New advertisements can be received up to noon of Wednesday of the week of issue.

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Entered at the New York Post-Office as Second Class mail matter.

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Of this issue of THE ENGINEERING RECORD, 14,000 *copies are printed. Total circulation for* 1905 *to date,* 592,500 *copies.*

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The Decision of the Board of Consulting Engineers of the Isthmian Canal Commission.

It has been stated in the daily press and repeated as if proceeding from authoritative origin that the Board of Consulting Engineers of the Isthmian Canal Commission has reached a conclusion in regard to the type of waterway to be recommended for the Panama Canal, or rather that two conclusions have been reached, eight out of the thirteen members voting unqualifiedly for a sea level canal with a minority of five voting unqualifiedly for a lock canal. That is a highly interesting as well as important issue. While it might have been better in some respects had there been a unanimous verdict, the divided conclusion will probably create a complete and thorough discussion, both in the Isthmian Canal Commission and in Congress, of the general features as well as the relative advantages and disadvantages of both types of waterway. If such a discussion should be conducted in a deliberate and judicial manner it cannot fail to result to the advantage of this great engineering enterprise.

Although a variety of statements have been made regarding the general features of the two reports which, it is understood, will be made by the majority and the minority of the consulting board, nothing authoritative seems to have been given out respecting the salient points of the two plans on which any arguments in favor of either can now be based. Apparently a minimum bottom width of 150 ft. has been adopted by the majority, but with a width of 200 ft. with vertical sides in rock sections, and it is further stated that the tidal lock at the Panama end of the canal is designed to afford a clear length of 1,000 ft. and a clear width of 100 ft., but nothing more is certain. Nor on the other hand does it seem to be known what are the channel dimensions or lock dimensions which will be adopted for the minority report.

Under these circumstances it would be unprofitable to enter into any consideration of the relative merits of the two plans; opportunity for that can only be afforded when the complete report is issued. As the foreign members have sailed for home, and as it is stated that the completed document will be taken to Europe for their signatures, it is clear that the report will not be made known to the public for perhaps a month yet.

In spite of these conditions which are obviously inevitable, certain portions of the daily press, particularly in the City of Washington, having partisan proclivities for the lock plan, have published overzealous attacks upon the majority for its decision. This would not be a matter of so much regret were not the five foreign engineers included in the majority. These eminent engineers have left their professional business at the invitation of the President of the United States and at great inconvenience to themselves, and probably at some financial loss, to serve on this board for an exceedingly modest compensation, whatever may be the gain in reputation attached to such distinguished service. It cannot fail to be a matter of the keenest solicitude on the part of the American public and particularly on the part of the American engineering public, that their treatment here, even by the public press, should have been of a courteous and considerate nature. Invidious distinctions between the members of the board have been made based upon the alleged professional performance or non-performance of certain classes of engineering work more or less affiliated with such construction as that of the Panama Canal. The intent of these attacks is apparently the creation of prejudice or other more or less sinister feelings in favor of the lock plan.

As has been frequently stated in these columns, The Engineering Record is in favor only of that plan of canal which will advance most the national and commercial interests of this country and it may properly be observed, even by this journal, that if the political advocates of the lock plan are to resort to that kind of procedure to which allusion has been made they are committing a fatal error. Whatever invidious distinctions may be attempted as respects the membership of the board it is worthy of note that the five foreign members were the only engineers on the board who have had to do with the construction, maintenance and operation of maritime canals, and that only two of the minority have ever had any experience in the construction, maintenance and operation of a commercial canal of any type. It is the judgment of this journal that such comparative observations are absolutely worthless and thoroughly obnoxious in character in connection with the decision of such questions, but they include facts which those who have been engaged in discreditable attacks upon members of the board should carefully observe, and hold their peace.

It is the proper part of every American citizen interested in the adoption of the right type of canal to suspend judgment until the reports are issued, so that the consideration of the question may be made with deliberation and follow from the careful weighing of the arguments set forth by both the majority and minority of the board. The members of that body were selected by the President with a careful view not only of their experience and eminence in engineering work, but also, it is fair to presume, from his belief, that they possess the requisite fairness of mind to pass upon all questions put before them without prejudice and wholly upon their merits. It is only fair and proper to assume that their deliberations have been characterized by precisely those qualities intended by the President.

The Proposed Municipal Lighting Plants for New York.

The Commission on Electric Lighting for the City of New York has lately submitted to the Board of Estimate and Apportionment a fourth report, which completes its studies for municipal plants for the most important boroughs of the city. The reports remaining unpublished are to discuss the cost of construction and operation of a plant to do all the public lighting on Staten Island, and the cost of lighting all the boroughs by constructing and operating transformers, wiring systems and other apparatus, the current to be bought from such private companies as offer to sell it to the city. The reports already issued take up the plants needed for the public lighting service of Manhattan, the Bronx, Brooklyn and Queens, and deserve very careful examination as a reliable basis for sane discussion of the advantages and disadvantages of municipal lighting in this city. They have been prepared by three men whose fitness for the work is exceptional. Dr. Cary T. Hutchinson, the chairman, was retained professionally about three years ago to examine certain features of the lighting problem in New York, and thus became well posted concerning the technical requirements for public lighting; Mr. Nelson P. Lewis, the secretary, is practically the city engineer of New York, owing to his position as chief engineer of the Board of Estimate and Apportionment, and Prof. George F. Sever, as consulting electrical engineer to the Department of Water, Gas and Electric Lighting, has long been engaged in an examination of the public lighting requirements of the several boroughs. The investigation now being made by these gentlemen is not a hasty and superficial survey of the situation, but a painstaking study of those conditions which must be carefully determined before it is possible to make definite arguments for or against municipal plants. The commission was appointed eleven months ago, at once opened offices and organized an engineering staff, and has been making what is doubtless the most important investigation of the public lighting subject ever undertaken for an American city.

The general scheme on which the plans are prepared was explained substantially as follows by Prof. Sever at a recent meeting of the Municipal Engineers of the City of New York: All plants are to have turbo-generator units furnishing 60-

cycle, 11,000-volt, three-phase current; the greater part of the auxiliaries are to be steam driven, and there will be duplicate exciter sets and a storage battery for excitation. Provision against shutdown has been made by interconnecting the central stations on each side of the East River and running duplicate high-tension feeders from the Manhattan power station to each sub-station in Brooklyn and Queens, and from the Queens power plant to each sub-station in Manhattan and the Bronx. By this arrangement a total interruption of service is made practically impossible. The sub-stations will contain the transformers for operating the series arc light circuits and for changing the pressure of a part of the supply from 11,000 to 2,200 volts, distributing boards for the single-phase branch feeders from the sub-stations to the various centers of distribution, and rooms for storing supplies used by the trimmers and other attendants in the adjacent district. Each center of distribution will contain transformers for changing the pressure from 2,000 to 230 volts for incandescent lighting and motor circuits and the distributing boards for the low-tension circuits from the center. The system of distribution has been designed for the close regulation necessary for good service, and to secure this it is planned to regulate the pressure at the transformers in each sub-station, either automatically or by hand.

The first of the commission's reports on this system of connected plants was submitted last February, and was based on a previous report made by Dr. Hutchinson, which was checked over carefully. This report states that a plant ample to duplicate the present public electric lights in Manhattan and the Bronx should be of 10,000 kw. capacity, and designed to supply 6,000 arc lights and the equivalent of 250,000 incandescent lamps of 16 c. p. The total cost of this station will be about $4,100,000 with sub-stations and distributing system. No allowance is made for underground ducts as the city has the right to free use of all duct space it needs in the subways already in use in these boroughs. The cost of operating the station and system is estimated at $906,000. The second report made by the commission appeared in June, after the city had bought sites for the two main stations in Manhattan and Queens. It stated that a plan to furnish all the light contemplated in the previous report and also replace all other forms of illumination in streets and public buildings in Manhattan and the Bronx should have a capacity of 15,000 kw. and would cost about $7,567,000. The net operating and fixed charges are estimated at $1,269,000.

The third and fourth reports were both submitted last month, and relate to the equipment for Queens and Brooklyn boroughs. The capacities of the stations on which the figures of cost were based are the same as those of the plants across the river. The plant for replacing the present electric lighting service for public purposes is estimated to cost $6,138,000, considerably more than the cost of the similar Manhattan station, because it is necessary to make provision for the construction of 156 miles of conduits. The station to supply this amount of service and also enough more current to replace all other forms of lighting in the public streets and buildings of these boroughs is estimated to cost about $9,485,000.

The figures indicate that these municipal plants will furnish lighting service for public purposes in Manhattan and the Bronx at $328,000 to $427,600 under the cost at the new rates prescribed by the Legislature, while in Brooklyn and Queens the municipal service will cost $27,000 to $68,000 more than private service, largely due to the necessity of constructing expensive ducts.

This is not the place in which to review in greater detail the contents of the four reports of this commission, for the important facts are given in the few figures already quoted. These show that, in the judgment of three specialists well qualified to express an opinion, municipal lighting would show a saving in two boroughs and a loss in two, but it is evident that when the two plants are considered together the saving so greatly overweighs the loss that it is best to discuss the two stations together. This is rendered still more advisable by the fact that it is proposed to connect the two main power plants together so as to relieve each other and thus obtain the advantages of duplicate plants. Considering the plants in this way and accepting the figures as correctly estimating the cost of the service from municipal plants, it will be seen that the total saving is not remarkably large. This is due to the fact that the Legislature has recently made an appreciable cut in the rates that may be charged for electric service and also to the very conservative allowances made by the commission on electric lighting. While the commission's estimates will be attacked, The Engineering Record believes that but little reliance should be placed on any contradictory figures unless reinforced by detailed information equal in character to that given in the commission's reports. This journal is furthermore of the opinion that the figures are as close to strict accuracy as such estimates need be. The discussion of them should not be on the accuracy of the estimates, but on the broader question of whether they show a sufficient reason for constructing municipal lighting plants for public service.

The decision concerning this question will be governed largely by the personal predilection of each disputant; some incline toward government ownership and others toward private control. Usually the data for a decision are so incomplete that feelings rather than judgment hold way, but in the case of the New York plant this is not the case. The question resolves itself down simply to the advisability of spending a large sum and organizing a new municipal department to gain a comparatively small saving in annual expenses. The Engineering Record sees no reason for believing that the construction and operation of such plants will not produce the saving, for the management would have to be extraordinarily incompetent to run up operating charges to the same extent as the interest-bearing water in the capitalization of the lighting companies in New York. On the other hand, these small stations should not be expected to furnish current as economically as the enormous plants of the private companies. Just where these two conditions balance each other it is difficult to say, unless the figures of the commission are accepted, which seems the most sensible thing to do. Consequently, the city is in the position of a business man who has capital and ability to introduce a new department yielding some profit but hesitates to make the investment and assume the trouble of directing the venture. In this particular case, most engineers will doubtless welcome the construction of the stations. The city of New York has an exceptionally good engineering staff which take deep pride in their work. It is safe to say that the works will be as well designed and as economically constructed as by private parties. The operating charges will doubtless be somewhat higher, owing to the shorter hours and higher wages of the men, which is the leading cause of high running expenses. On the whole, however, if there ever was an opportunity to give municipal ownership a fair trial it is in connection with the public lighting of New York City. The loss of the public business to the private companies in the city will be trifling. The information gained by the operation of these stations under careful supervision by competent technical advisers will furnish definite information on many features of public lighting that remain hidden behind a cloud of wordy argument at present.

Local Engineering Societies.

In reviewing the proceedings of a number of local engineering societies recently, the importance of the papers and the value of the discussions was a matter of surprise. The Engineering Record necessarily keeps in touch with local organizations of an engineering character, but must confess to a previous lack of full appreciation of the scope and value of their collective contributions to technical information. This journal is glad to make the confession of partial ignorance, for it has long held the position that local societies, bringing together everybody interested in engineering subjects in a district, were essential for the best interests of the profession. The national organizations are the guardians of professional ethics and the bodies where the great problems of engineering are best discussed. On the other hand there are far more subjects, of a minor importance or of local interest, which are just as likely to arouse profitable discussion, provided they are presented before a society where all the members are at least somewhat acquainted with them. The importance of last year's papers before local societies is due to the fact that these have often related to some of the most important engineering works in the country or else have taken up in detail special methods of construction or the results of operation of engineering plants, thus furnishing a class of information that is generally lacking in the proceedings of the national associations or in the pages of the technical press.

Another feature of the work of these local engineering societies that is deserving of cordial approval is the freedom and high character of the discussions. One of the drawbacks of the engineering profession is that it tends to place those following it decidedly at a loss in business intercourse. Engineers rarely have occasion to explain their work to people without technical training, and consequently do not acquire the facility of expression in forcible English that lawyers and physicians possess. This lack of ability to express themselves promptly and accurately is a serious drawback, because nothing is more likely to write a man down as an ignoramus in the eyes of men of affairs than a report only partly intelligible and full of useless repetition, which, after it is submitted, is very likely called back for correction and explanation. The lawyer who could not argue a case clearly and accurately, but required a second opportunity to appear before a court in order to correct his mistakes during the first arguments, would not be rated as a man worth retaining, and in the same way the engineer who cannot state his case clearly, concisely and accurately lacks one of the most important attributes of a successful man. Nothing will afford this desirable facility and accuracy so well as experience in technical discussion, and for this reason the opportunities offered at local societies are deserving of marked approval and encouragement.

Another feature of the work of these organizations which is evident from an examination of their printed proceedings is the excellent results they are accomplishing in bringing together engineers, contractors, foremen and supply-men in a single room, where everybody has equal right of speech, and discussion by the younger men is particularly encouraged. The good results that are following from the acquaintances made between civil, mechanical, electrical, mining and architectural engineers in such societies are an important factor in broadening the perspective of the members. It is necessary in these days to confine one's attention to a few specialties in order to achieve the highest results, but success in such limited fields can only be attained by those who keep in touch with the general progress of engineering. While the engineering press can help in giving this general information it is not a substitute for such a direct acquaintance with the details of other classes of work that it is possible to obtain through a complete utilization of the opportunities afforded by well-managed local associations.

These societies are also the field in which the representative of manufacturing interests can best present his side of a disputed subject. This journal has long insisted that a great deal of the progress in engineering is due to manufacturing corporations. Many of them have gathered together on their technical staffs men of the highest professional reputation, and now that the ranks of salesmen are being recruited from engineering graduates who have been given shop practice before their connection with the sales department, it is self-evident that their opinions on work falling within their fields are as likely to be worth consideration as the remarks of engineers engaged by cities or by railways. In fact some of the best papers of the past year have been contributed to local associations by these engineering salesmen, who find in the opportunities for free discussion which such societies afford the means of talking over, in a strictly professional way, the important discoveries or improvements made by the engineers of their companies.

Notes and Comments.

THE FREEZING OF COOLING WATER for the jackets of internal combustion engines may be guarded against, it is said, by the using of a 20 per cent. solution of glycerine. Its advantage over the usual brine or chloride of calcium solutions is that no deposit forms on the hot cylinder walls when the engine is in use.

THE CONTROL OF STREET RAILWAY TRACKS in English cities is in most cases in the hands of the city surveyors, although the operation of the cars and power plants is left to the tramway managers. The latter are now endeavoring to secure control of the tracks, on the ground that they can keep them in condition more economically than can the surveyors. This claim is being strongly opposed by the "Surveyor," the journal representing the interests of British city and county engineers, and The Engineering Record subscribes heartily to this opinion. Where a street railway is owned and operated by a city, as in the cases referred to, it is manifestly to the public interest to keep all street constructions in the charge of the city engineer, who will see that justice is done to all interests. Where the tracks are the property of a private corporation, this relation must be changed, for it is contrary to all principles of justice, to give absolute control over the property of one person into the hands of another. In such cases, if the city prescribes the kind of track which may be laid in the street and the extent to which the pavement near the track is to be kept in repair, it has done all that it is reasonable to require.

GOVERNMENT RESEARCH in technical subjects is always likely to arouse criticism on the ground that it trenches on the legitimate work of private parties. This view is apparently held by "The Engineer" of London, in some decidedly sharp comments on the way in which the National Physical Laboratory is run. This institution was established "for the testing and verification of instruments for physical investigation, for the construction and preservation of standards of measurement, and for the systematic determination of physical constants and numerical data useful for scientific and industrial purposes." It has published five papers since it was established, which give the results of its research work. It has also published a price list in which, according to the journal named, it expresses "readiness to carry out ordinary tests and analyses for individuals and firms." This is apparently done to secure funds for the legitimate work of the laboratory, but if all the criticisms made by the London journal are correct, ordinary commercial testing which should be left to private firms is receiving far more attention than was ever intended when the undertaking was authorized.

A POOLING AGREEMENT between two contractors has come to grief in the U. S. Circuit Court for the Western District of Pennsylvania, 139 Fed. Rep. 780. The War Department ordered the Jones & Laughlin Steel Co. to remove a quantity of slag it had dumped into the Monongahela River, and so the company asked two dredging contractors to bid on the work. They promptly put their heads together and tendered \$1.60 and \$1.70 per cubic yard for the work, although it was eventually done at a cost to the contractors of 9 cents. The two contractors agreed that each was to do half the work, no matter to which party the award was made. The Jones & Laughlin people considered these prices too high and rejected both bids. Subsequently the U. S. Engineer Officer modified the requirements for the work and a tender of \$1.25 from one of the contractors was accepted, in accordance with which the slag was removed and payment made for the dredging. The other contractor thereupon brought suit for an accounting in accordance with the agreement. The court refuses to entertain such a suit on the ground that the agreement was a conspiracy to defraud the steel company and as such was illegal and void. "Viewed from the standpoint of morals, square dealing and commercial integrity, combinations for collusive, misleading biddings, wherever made, cannot be approved."

THE ELECTROLYSIS OF WATER AND GAS PIPES is now being brought to the forefront of topics of current technical interest by some of those who, until recently, have treated it as too trivial to deserve attention. The street railway and electrical journals have heretofore followed the lead of the electric supply men in refusing to grant much significance to electrolysis of underground conductors, and have even exceeded the manufacturers of car equipments in their expressions of contempt for publications that have asked for a fair deal for water-works and gas companies. These editorial partisans must consequently feel extremely uncomfortable at the predicament in which they are left by the recent rejection of their pet views by the Westinghouse engineers. For example, in the last number of the "Electric Journal," Mr. P. M. Lincoln says: "This matter of electrolysis is admittedly one of the most serious that the operators of the direct-current traction system are confronted with; first, because of the difficulty in applying any remedy in the universally used rail-return system, and, second, because of the insidious character of the evil, immense damage may be done before it is realized that any remedy is needed. . . . . Evidently there are two ways of preventing electrolysis, first by keeping all current out of the ground, which is impossible with the rail-return system, or second, by making the currents that flow in the ground innocuous. Tests by Mr. Kintner indicate that a ready method of accomplishing this result is to make the currents alternating." More than this was never claimed by the most ardent advocate of fair treatment for the owners of the gas, water and telephone conduits that are being ruined by the wandering currents from street railways. The fact that these statements and others like them come from the engineering experts of a company which is the pre-eminent advocate of alternating current equipment for railways, as it was the pioneer for alternating current apparatus for power transmission, does not in any way detract from their great importance, for the company also manufactures a great number of direct-current car equipments and is unquestionably actuated in this matter solely by the teachings of its long experience in making and testing all kinds of railway apparatus.

THE NEW ORLEANS SEWERS have recently been submitted to a searching examination by an advisory board of engineers consisting of Messrs. B. M. Harrod, Rudolph Hering, George W. Fuller and A. C. Bell. It was asserted by a contractor engaged on the work that a lack of foundations under some of the sewers would cause their ruin, but this fear is declared unwarranted by the board. From its inspection of representative portions of the work, the board unhesitatingly declares that the work has been well done, comparing favorably with current practice in sewerage construction throughout the country. Of the 118.2 miles of sewers that have been accepted for final payment, but 317.5 ft. showed defects that had to be repaired before acceptance. When the examination for final payment was made the work had been under way for some months, during which time any settlement due to insufficient foundations or other defects would presumably have been revealed. There are other cases, however, in which defects have been observed, not of great extent, and in making final settlements for them the board advises adopting the principles it outlines as follows: "Pipe may break in the sewer for several causes. It may have been improperly manufactured and not able to bear the weight of the soil. It may be unduly loaded by excessive backfill above the surface. It may break from defective joints, which cause leakage, from improper backfilling, which would produce undue strains upon the pipe, and from other causes, for all of which the contractor is responsible. On the other hand, there are causes for the settlement and breaking of the pipe for which the contractor should not be held responsible. Besides disasters and any occasions over which the contractor has no control, there is the judgment as to the bearing power of the soil at the bottom of the trench. Special experience as to the behavior of a particular kind of soil under new conditions is necessary to guide the decision as to whether a special foundation for the sewer is required or not. If it is required, this experience should designate the character of the foundation. The engineers of the work, and the inspectors acting under their directions, have, therefore, the right and are best able to give orders regarding the necessity of placing such foundations. In cases where this judgment is erroneous the contractor clearly is not responsible for the results following such omissions. As to the facts causing the failure of the parts of the sewer now under consideration, we find that the evidence is inconclusive, whether the responsibility of repairing these sewers rests upon the contractor on account of improper material or imperfect work, or upon the city, on account of an error of judgment in omitting foundations where required. Under these conditions we advise that the differences between the Sewerage and Water Board and the contractor be adjusted by an equal division of the costs." In this connection, it should be noted that the board does not believe in the use of concrete as a foundation for sewers in such soil as that of New Orleans, but states its preference for a platform of timber, which is less expensive and does not impose such a weight on the soil. The custom of placing a heavy spoil bank along the line of a trench in compressible soil is strongly condemned, as it should be.

THE RECONSTRUCTION OF THE POUGHKEEPSIE WATER FILTERS.

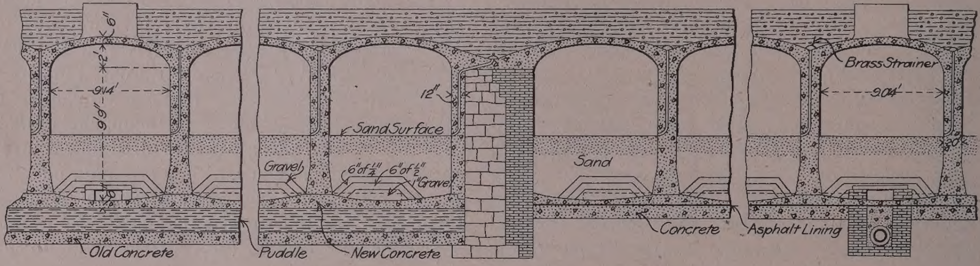
The New Features of the First Water Filters in the United States.

The open sand filter plant of the Poughkeepsie, N. Y., water works has been completely reconstructed and covered. The plant originally consisted of a single bed, 150x200 ft. in plan, divided longitudinally in two sections by a wall at the center. This bed was designed by the late James P. Kirkwood, and was the first sand filter built in this country. It was first put in operation in 1872 and remained continually in service from 1876 until its reconstruction was undertaken last spring. In 1896 a second bed, 114x260 ft. in plan, was built adjoining it and the two beds have been used since then to filter the water supply, which is drawn from the Hudson River.

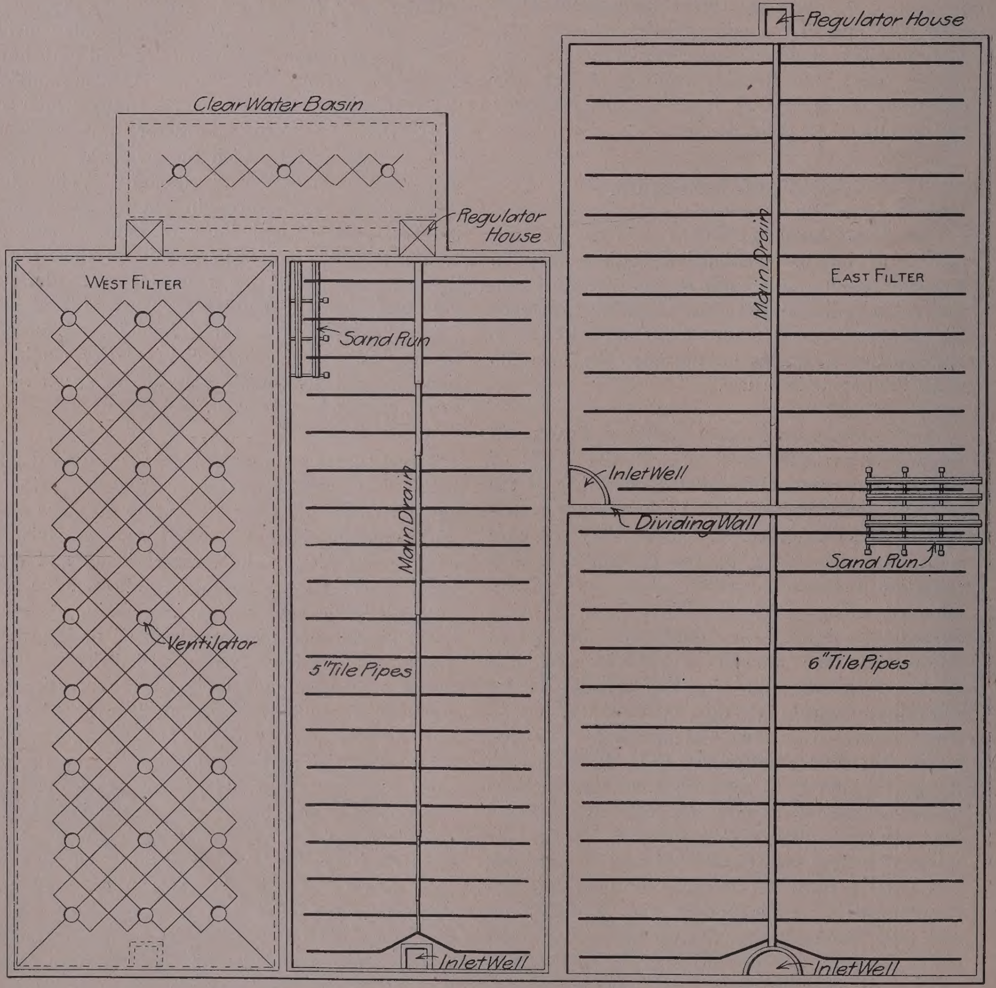
The operation of the open filters was attended with no small difficulty. Ice forming on them in winter had to be removed at an excessive cost and greatly hindered the maintenance of the beds in proper working condition. In summer algae growths frequently took place on the surface of the sand and spread until the entire surface of the bed was covered and the passage of water completely stopped. These growths did not develop in the dark and very little in the shadow of any object. Leaves and other debris blown about by the wind, moreover, would fall in the water in the beds, and when water-soaked would sink to the surface of the sand. The filters were constructed partially on filled ground, so that unequal settlement had taken place, resulting in cracks, with a loss of water, and also in the flow of water from one section to the other of the old bed, adding serious interference to the operation of the plant. In order to overcome these various difficulties practically new covered filters have been built, which are constructed according to the best modern practice.

The influence of the tide is felt to considerable extent in the river at Poughkeepsie, but the intake of the water works is several miles above the zone of brackish water, except at extremely rare intervals. The width of the river at the intake is about 2,400 ft., with a nearly uniform depth of 50 ft. The intake consists of a 24-in. cast-iron pipe extending 100 ft. into the river, with its outer end 35 ft. below low water. The watershed of the river above it contains a population of more than 1,000,000—500,000 of which is urban. A state hospital for the insane, containing about 1,500 inmates and attendants, is located just above the filter plant, and has a complete sewerage system which has its outlet in the river a little more than half a mile above the water works intake. The central outfall sewer of the Poughkeepsie system discharges into the river 6,124 ft. south of the intake. The flood tidal currents in the river pass some distance above the latter, but nearer the center of the river. The result is that the river water is heavily polluted with sewage at all times, although its bacterial content is comparatively low, making it a difficult water to purify by filtration.

The original equipment of the pumping station consisted of a 3,000,000-gal. low-lift, duplex, non-compound Worthington pump, which pumped the river water to the old filter beds, and a 3,000,000-gal. compound Worthington pump, which pumped the filtered water against a head of 120 lb. to an elevated distributing reservoir. These two pumps were installed in 1872 and performed the entire service of the plant until 1893, when a 5,000,000-gal. Gaskill pump was added and has since pumped most of the water to the distributing reservoir. A 10-in. Worthington centrifugal pump, driven by a 35-h.p. vertical, two-cylinder, four-cycle type Westinghouse gas engine, has replaced the old Worthington pump for raising the river water to the filters. This gas engine is supplied with gas by a 50-h.p. suction producer made by R. D. Wood & Co. The whole installation has proven very economical and efficient; during the month of October it consumed on the average 1.42 lb. of coal per horse-power per hour. The conditions under which it operates and the results of a test made on it were described in The Engineering Record, July 1, 1905. Both old Worthington pumps are still in working condition after 33 years of service and are held in reserve.



Details of Reconstructed Poughkeepsie Filters.

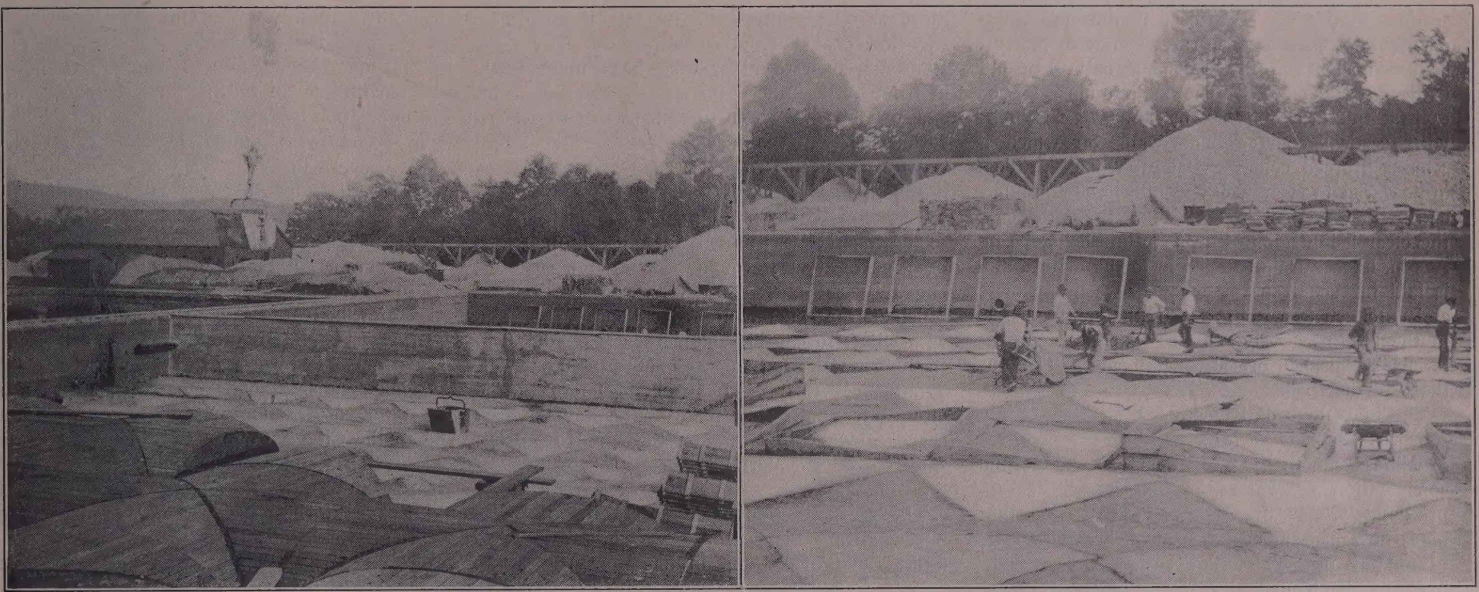


Plan Showing General Arrangement of Filters and Clear Water Basin.

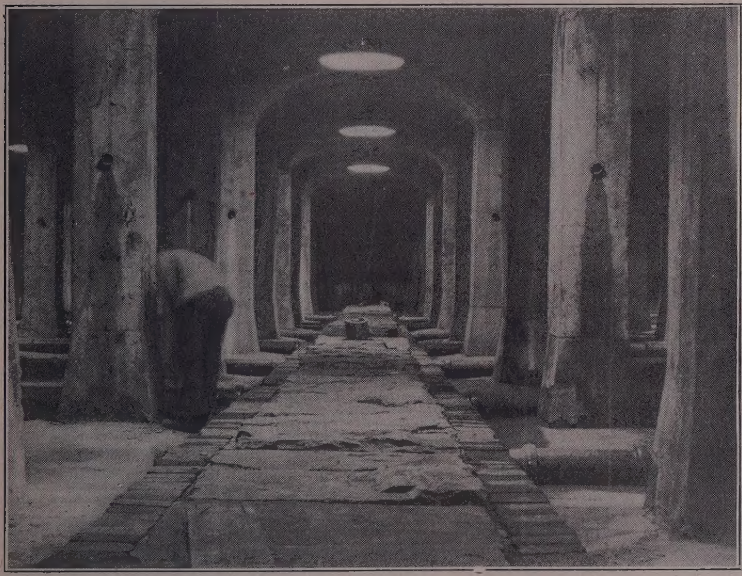
The filter plant is 28 ft. above the river, and the low-lift pump elevates the river water to a 25 x 60-ft. settling basin, 12 ft. deep, from which it flows to the two filter beds. An inlet well was placed on the center line at the end of each section of the old bed. This bed had vertical rubble masonry walls and a concrete bottom, its total depth being 12 ft. The filtering material occupied one-half this depth, comprising, beginning at the bottom, 2 ft. of fairly large broken stones, 6 in. of 2-in. gravel, 6 in. of 1-in., 6-in. of ½-in., 6 in. of ¼-in. gravel and 24 in. of sand. A main drain of dry rubble, 2x2 ft. in cross-section, extended longitudinally down the center of each section, with two transverse lateral drains of the same dimensions in each section of the bed. A gate was placed at the outlet end of each main drain, opening into a 6x88-ft. intermediate chamber, 16 ft. deep, built along the outlet end of the sections. The water passed from the chamber over a weir into a 28x88-ft. open filtered-water basin, 17 ft. deep, then to the pump in the station building, which raised it to the distributing reservoir.

The new filter bed built in 1896 was at one side of the old bed, with its wall on that side nearly against the wall of the latter and the walls of the two beds in line at their inlet ends. The new bed had a concrete bottom and side walls of rubble masonry, laid in Rosendale cement mortar and faced with brick laid in Portland cement mortar, the inner faces of the walls being vertical. Along the old bed buttresses were built between the walls of the two beds and the space between the buttresses filled with brick laid in cement mortar. The bottom of the excavation in which the bed had been built varied from soft muck to solid rock. The muck was removed and the rock leveled, then the site was brought to sub-grade with fine cinders well rammed in place. The bottom was laid directly on the cinders and consisted of 12 in. of Rosendale cement concrete, placed in two layers.

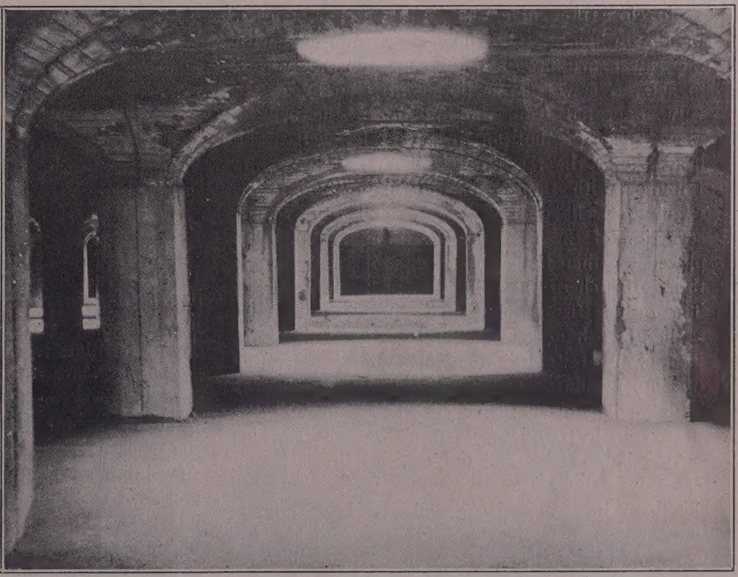
An 18-in. connection was made to the small settling reservoir and water admitted to the bed through a distributing well, 2 ft. wide, which extended across the inlet end and had the top of its inner wall level with the top of the sand in the filter. A main drain, rectangular in cross-section and with loose brick sides and a stone slab top, was placed below the level of the surface of the concrete bottom and extended the length of the bed along its longitudinal center line, with 6-in. lateral tile pipe drains on 10.25-ft. centers on the concrete bottom. These lateral drains were covered with 2-in. broken stone. The spaces between them were filled to a depth of 10 in. with 2-in. broken stone and 1-in. gravel, above this was an 8-in. layer of ½-in. gravel, over which was a 6-in. layer of ¼-in. gravel. On top the gravel was 31 in. of filter sand. The main drain discharged into a 6x8-ft. delivery well outside the wall of the basin distant from the inlet end, a connection being made between this well and the clear-water well of the old filter.



Construction Views Showing Forms for Roof, Floor Construction and Trestle Carrying Narrow-Gauge Track.



Main and Lateral Drains on the Bottom of a Filter.



Interior of a Bed With Sand in Place.

In the reconstruction work as much of the materials and masonry of the old beds as possible was utilized, but owing to the nature of the changes and the character of the construction in the original bed, the latter is replaced by practically a new bed. The general features of the reconstructed work and the covers built over the old beds are so well shown in the accompanying illustrations that only the details need any explanation. The bed constructed in 1896 was rearranged and covered first. The filtering material in it was removed and stored near the work. The wall across the inlet end forming the distributing well was also removed and the underdrains taken out. The bed was divided in two distinct sections by a concrete wall on its transverse center line, and these two sections provided with separate inlet and outlet connections so each of them may be operated as a unit. The concrete bottom was swept clean after the filtering material and underdrains were removed and the alterations made. It was then coated with liquid asphalt, in which hemp burlap was laid, and covered with hot asphalt until the total thickness of the coating was ½ in. The coating was also continued 1 ft. up the side walls. Over this coating an inverted groined-arch concrete bottom, the details of which are shown in the accompanying illustrations, was laid for the new work.

In order to provide connections so the two sections of this bed could be operated as units the inlet, underdrains and outlet had to be changed completely. An inlet well was built at the center of the end wall to replace the old well which extended the width of the bed. The main drain was removed and the space it occupied below the level of the floor filled flush with the latter with concrete. The old main drain and laterals were then replaced, one lateral being put along the center line of each transverse bay between the piers. The main drain was connected at the dividing wall between the sections to a 12-in. cast-iron pipe, with lead joints, leading through the other section of the bed to a regulator house built on the site of the delivery well of the old filter. Where this pipe was laid through the other section it was placed in the space formerly occupied by the main drain and then imbedded in concrete.

An inlet well was built in the corner of the second section at the dividing wall and adjacent to the original bed. The main drain in this section was relaid over the concrete covering the 12-in. cast-iron pipe. The lateral drains were relaid the same as those in the first section. The filtering material in the old bed on this site was thoroughly washed and largely used in the reconstructed bed, but considerable new sand was required. The arrangement of the filtering material in these beds is shown in one of the accompanying illustrations.

The reconstruction and covering of the original bed involved considerably more work than was required in the improvements made on the bed built later. The two sections in which the original bed was divided were retained. The surface of its concrete floor was 2 ft. below the floor of the other bed, and after the filtering material had been removed, 2 ft. of puddle was placed directly over the old concrete floor. An inverted groined-arch concrete floor was then laid on the puddle, bringing the grade of the floors of all the four sections to the same elevation. The rubble masonry side walls were thoroughly cleaned and then lined with 12 in. of concrete, sufficiently reinforced to insure stability. The details of the groined-arch roof placed over the bed and of the piers supporting it are the same as those in the other bed, the piers being 18 in. square.

The large stones in the underdrains and the lower part of the filtering material in the two sections of this bed were used in the puddle under the floor, placed as rip-rap on some of the embankment slopes around the plant, or broken and used in the concrete. The main underdrain of each section was replaced by a main drain built with vertical concrete side walls on which a 4-in. reinforced concrete slab was placed. This drain varies in clear width from 8 in. at the inlet-end of each section to 3 ft. 8 in. at the outlet end, the clear height along its center line being 10 in. A 5-in. lateral drain, connected to the main drain, is laid in each transverse bay between the piers and extended to within 4 ft. of the side walls, as in the bed previously rebuilt. The filtering materials in this bed are also arranged the same as those in that bed.

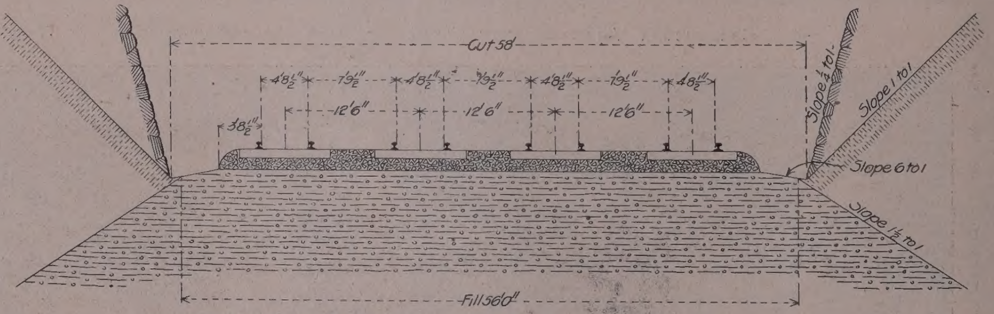
The two old beds have thus been divided into four separate beds, each having a net filtering area of almost exactly 0.33 of an acre. The normal consumption of water in Poughkeepsie is approximately 2,300,000 gal. a day, so the filter plant now has sufficient capacity at proper rates of operation. The inlet pipe of each new bed in controlled by a double-beat valve in its inlet well, which is governed by a float on the surface of the water in the bed, set so as to close the valve when the water reaches a maximum height. Overflow pipes connected with the sewer are provided in case the valves fail to act. A sewer connection controlled by a gate valve operated from the outside of the bed, is placed near the bottom of each inlet well. The houses over the regulator wells have brick walls trimmed with sandstone, and slate roofs. The regulator wells of the beds made by the reconstruction of the first old bed to be changed are placed together under one regulator house, while those of each of the other two beds are separate. The outlets from the main drains are each controlled by a hand-operated gate valve in the regulator well of its bed, the valve stems extending up into standards on the floors of the regulator houses. The discharge of each bed is meaured by a weir in its regulator well. The rate at which a filter is operating and the head lost in it is indicated by gauges in the regulator houses actuated by floats in the regulator wells. A large double-door entrance is provided in each filter at one corner. Plank runways, suspended from the roof piers and side walls, are placed in the beds at these entrances to facilitate the removal of the filtering materials. A 36-in. circular ventilator and manhole is placed in each alternate section of the roof and provided with suitable sheet-iron covers placed on cast-iron frames set in the concrete. The arched filter roofs are covered with 2 ft. of earth fill.

The intermediate chamber between the original filter bed and the clear water well was divided transversely by four walls of concrete, two at each end, under the regulator houses. It was also covered by reinforced concrete slabs. The central division thus formed is connected with the clear-water well, and the regulator wells of the other two beds are also connected with the latter. The clear-water well was covered with a timber roof several years ago. This roof was removed and the side walls lined with reinforced concrete, then a groined-arch concrete roof, supported on the side walls and on piers carried up from the floor, was built over the well.

The filter plant is built in a very limited space leveled off between the main line tracks of the New York Central & Hudson R. R. on one side and high ground on the other. The reconstruction work was much hindered by the lack of proper working room. A Lidgerwood cableway was set up spanning the first bed rebuilt, and all materials handled in buckets by it. The filtering materials removed from the beds were stored wherever space could be found. A temporary trestle carrying a light car track was built parallel with the ends of the filters and just inside the cableway tower at the outlet end of the latter. A Ransome concrete mixer was placed immediately in front of the other cableway tower at the inlet end of the filter, and the concrete carried to various parts of the bed in buckets on the cableway, or in wheelbarrows. Similar arrangement of the plant and methods of carrying on the work were followed in rebuilding the original bed.

The concrete was mixed wet in the proportions of 1 part Atlas Portland cement, 2 parts sand and 4 parts broken stone, ¼ to 2½ in. in size. Much of the concrete joined old masonry coated with slime, so considerable care was exercised in cleaning all the old surfaces before concrete was laid against them. The concrete floors of the filters were laid in alternate squares and the arch shapes made with straight screeds on the forms. The remaining squares were screeded to those of the first set.

The reconstruction of the first bed was completed during the season of 1904 and the two filters thus formed put in operation before the two sections of the old bed were thrown out of service. The reconstruction of the latter was commenced late the same season, but owing to unavoidable delays that had occurred in the previous work it could not be completed until this year.



Typical Cross-Section of New York, Westchester and Boston Ry.

The plans for the rebuilding and covering of the beds were made by Mr. Chas. E. Fowler, superintendent and engineer of the board of public works of Poughkeepsie, and the construction work has been carried on under his immediate supervision. Mr. Allen Hazen, of New York, was consulting engineer on the work. The Crouse Construction Co., of Perth Amboy, N. J., was the contractor.

Reinforced Concrete Structures of novel design have been adopted for many purposes on the North Platte project of the Reclamation Service. For example, in the approaches from ditches to flumes, the walls of concrete 1 ft. thick are reinforced by horizontal 5/16-in. rods on 3-in. centers spaced 2 in. from each face. These walls are supported by buttresses 2 ft. thick at the top and 3 ft. at the bottom, in a typical case, and 7 ft. 9½ in. apart on centers. The wall is tied to each buttress by 5/16-in. steel rods. Some of the flumes are large, one of them having a central arch of 53 ft. 7 in. and side spans of 30 ft., with spandrel arches above, carrying a reinforced concrete flume 34 ft. wide and 12½ ft. deep.

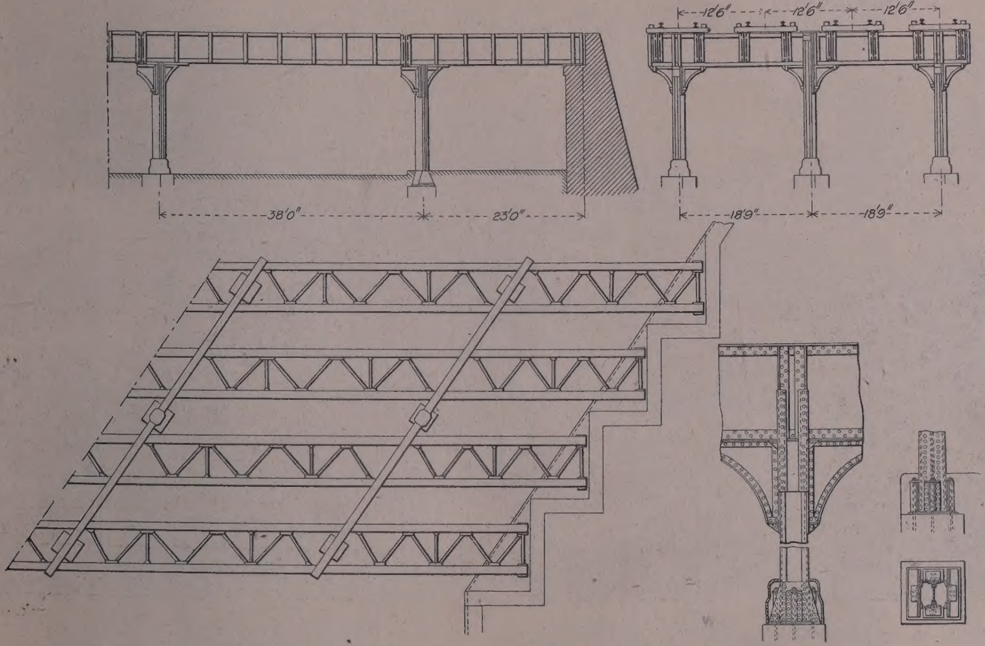
The New York, Westchester & Boston Railway.

The first division of the New York, Westchester & Boston Ry., a four-track suburban electric line, extends about thirty miles northeast from the Borough of the Bronx, New York, along the high ground a few miles back from the Hudson River and approaching the shores of Long Island Sound. It passes through localities desirable for residences, many of which are not yet built up, but are already experiencing great appreciation of values in conseuence of the facilities promised by the railway. This division connects New Rochelle, Mount Vernon and smaller towns, and serves a district containing many extensive estates. For a considerable distance it lies between the existing steam railroad and the shore, where the population has extended most rapidly, and it is approached by a number of short local trolley lines which will act as feeders. It is, therefore, believed that this division will immediately secure a large local and suburban traffic much of it included with that of the Interborough Rapid Transit lines. The road will be operated by the New York, Westchester & Boston Railway Co., of which Mr. W. L. Bull is president. The bonds were placed and other financial transactions managed by Messrs. Dick & Robinson acting as syndicate managers. The general contract for construction and equipment was awarded to the City & County Contract Co., of which Mr. T. D. Rhodes, formerly receiver of the Detroit Southern R. R. Co., is president, and Mr. H. C. Winchester, secretary and treasurer. Through this company Messrs. James P. McDonald has contracts for grading and masonry, and J. H. Flick & Co. and the McLaw Brothers Construction Co. hold sub-contracts for different portions of the work.

The work is being executed under a charter granted in 1872 for the construction of a road from the Harlem River to Boston, and under a New York City franchise granted Aug. 2, 1904, and a subsequent franchise in Westchester County. The first division consists of a four-track line of 4.12 miles from Willis Ave. and the Harlem River to the present terminus of the Lenox Ave. branch of the Rapid Transit Railway viaduct at 177th St., near Bronx Park, where a connection will be made with the latter, thence 4.89 miles to City Line (a section now under construction), thence 13.21 miles to Port Chester, at the boundary line between New York and Connecticut. There are also two-track branches, one of 6.06 miles from the Bronx River to Throgg's Neck, and another of 10.57 miles from City Line to White Plains, making a total of 38.85 miles.

The principal towns passed through are Mount Vernon, New Rochelle, Larchmont, Mamaroneck, Rye, Port Chester and White Plains, having a combined population of about 70,000, but the population of the 58 square miles of country considered tributary to this division of the road is about 110,000, and it is believed that a large percentage of the people will become patrons of the road on account of its greater convenience and lower charges, which will also attract new residents to the district. A careful preliminary investigation of the traffic probabilities was made by the chief engineer, and from the data thus obtained it was computed that the sum of the annual payments to the steam railroad for passenger transportation in this district averages about $12 for each man, woman and child of its population.

The line is in all places located on a right-of-way 100 ft. wide, and in some places where the line intersected building lots the whole lot was purchased, although only a small portion is occupied by the 100-ft. strip. Generally these lots are salable so that, as they were mostly secured before the location was announced, little ultimate additional expense is involved. The line is carried almost everywhere above or below the original surface of the ground so as to avoid any grade crossings. About equal portions of the track are elevated and depressed, care having been taken to locate the alignment so that the cuts about equal the fills, providing everywhere solid embankment for the tracks above the surface. It being an exceedingly difficult matter to secure a balanced profile and at the same time go over or under all streets or roads without too much change to their grades, many preliminary lines were run. Between New Rochelle and Mount Vernon thirty prelininary lines were surveyed and from them a 4x6-mile territory was mapped to a scale of 200 ft. to the inch with 5-ft. contours, thus making such an accurate topographical record that any line can be platted on it and satisfactory profiles drawn in the office. All lines were run with transit and level, and in the country between them plane table and stadia methods were used to some extent.



General Construction of Baychester Ave. Viaduct.

The line already located crosses under the line of the New York, New Haven & Hartford Railroad twice, and over it once; it crosses under trolley lines thirteen times and over them seven times, under streets and highways forty times, over streets and highways fifty-three times, and over the principal running streams twelve times. All these crossings are made with plate girder bridges, the longest span being about 100 ft. The sub-structures for the bridges are generally concrete masonry abutments and vertical steel intermediate columns. Most of the concrete is made 1:3:5 with Vulcanite Portland cement and broken trap rock from Hudson River quarries, the local stone not being considered suitable. Proposals were considered for building substructures with blocks of molded cement and sand, to be 3x3x1½ ft., but they were abandoned because they could not be furnished in time. All masonry footings are carried down to foundations on rock.

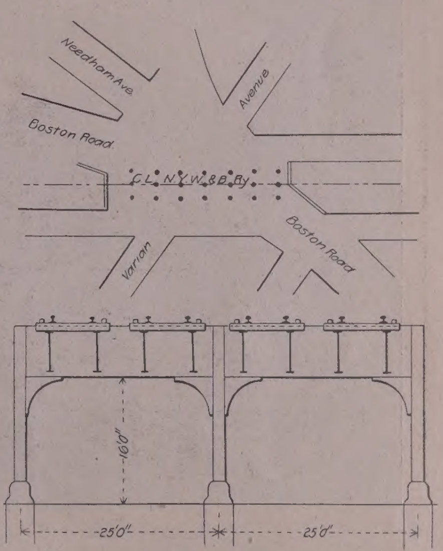
The tracks are 12½ ft. apart on centers, and the width of the four-track road bed is 56 ft. in fill and 58 ft. in cut. Three-track and two-track cuts are respectively 44 ft. and 32 ft. wide at the bottom. The cuts in earth are sloped 1:1, and will be sodded, and are ¼:1 in rock. As the average depth of the cuts is less than 25 ft. these dimensions usually allow the excavation to be made within the right of way without the use of retaining walls, although low walls may in some cases be necessary for the toes of deep cuts or high embankments where the ground is too costly to make it economical to buy more than 100 ft.

A large part of the location is over very rough ground and there will be much more rock than earth to excavate. The rock, which is a hard micaceous gneiss, outcrops in many places, and is very irregularly stratified. The estimates for the whole division give about 1,632,000 yd. of rock, 363,000 yd. of earth excavation, 205,000 yd. of masonry and 15,000 tons of steel. The rails will be 90 lb. for the track and 100 lb. for the special third rail, all laid on wooden ties in heavy stone ballast.

The tracks have, naturally, been kept as close to the original surface as possible, but as there is 16 ft. clearance above the base of rail and the same height above city streets, and as a height of 4 ft. is required above the top of the subway construction and the surface of the city streets to provide for pipes, conduits, etc., these conditions, with the depths of girders and floors, result in a pretty uniform average of about 23 ft. up or down from the base of rail to the grade of the intersecting streets. In most cases the grade does not exceed 0.6 per cent., which is practically the governing amount for operating. The extreme maximum is 1.3 per cent., which is on a section of track only about 500 ft. long at a station. In general the curvature is not more than 2 deg., and the extreme maximum is 5 deg., which also occurs at or near principal stations, and will not interfere with a high speed schedule. The track and the motors will be designed for a speed of 65 miles an hour for express trains, which will occupy the two center tracks. A minimum of 60 trains each way every 24 hours must be run inside the New York City limits. Local stations will be about 1 mile apart and express stations about 2 miles apart. The station buildings will be made with steel frames and fireproof construction, and on depressed tracks, will usually be located on the surface of the ground in intersecting side streets; for elevated tracks they are also located at the ground level between the curb of the intersecting street and the abutment of the overhead bridge.

The deepest cut on the first division is under the East Chester highway, and is 37 ft. deep, about ½ mile long and requires about 270,000 yd. of excavation. The longest cut is under the Pelham Parkway and is about 1 mile long. The cuts are drained to both ends with heavy side ditches.

The specifications have been based on the best features of the specifications of a number of the most important Eastern steam railroads. Structural and bridge steel will be governed in general by the standard specifications of the American Society for Testing Materials and cement by the recommendations of the American Society of Civil Engineers. The line will be equipped with its own telephone, telegraph and electric light systems, and with automatic interlocking block signals. The rolling stock will conform in general to that of the Interborough Rapid Transit Railway except where some features are improved. Steel motor cars with end and side entrances will probably be used. There will be one centrally located power plant with a capacity of about 15,000 kw., and three sub-stations, one of them at the power plant.



Boston Road Crossing.

Wherever the tracks are carried over streets and highways and the headway is sufficient, the bridges are made with deck plate girders supported on abutments, which also serve as retaining walls for the adjacent embankments, and on intermediate single vertical columns, generally independent of each other and not braced except by kneebraces at the top, on account of the municipal requirements that there shall be no horizontal obstructions between columns. The concrete abutments are made integral with the wing walls and have expansion joints at or near all angles. They have vertical faces, slightly projecting concrete coping, and back walls carried up to the top of the girder. The minimum thickness is 4 ft. on the coping, and the rear is battered 1:5 in a uniform slope from top to footing, without offsets. Where, as is often the case, the girders are skewed considerably with the abutment face, the seats are made with a horizontally stepped back wall affording squared seats for each track and enabling the pairs of girders or stringers to be set opposite each other, thus avoiding special or skew ends and bracing for the superstructure.

At ordinary square crossings over country roads the bridges are from 40 to 60 ft. long, and are made with single-span girders seated on abutments. In cities and towns the minimum length of bridges over streets and sidewalks is about 60 ft. and there are usually three spans, one across the street, carried on columns set on the curb line, and the other two across the sidewalks, supported at one end on the columns and at the opposite ends on the abutments. Where streets are crossed at a large angle, or where the crossing is at the intersection of several streets, the problem was more difficult, but its solution was aided by the disposition of the city and county officials to aid by the approval and acceptance of simple and convenient construction.

Usually the columns are arranged in bents parallel to the curb, or perpendicular to the axis of the bridge, but located so that transverse sets of them are parallel with the axis of the intersecting streets. An interesting example of this arrangement is afforded by the Boston Road crossing in the Borough of the Bronx, where several streets and roads intersect, as indicated in the diagram, and for a distance of four miles there is a parallel 50-ft. road carried each side of the tracks, thus making a decided street improvement. Here the distance of 373 ft. between abutments is divided into one span of 24½ ft. and seven spans of about 50 ft. The vertical columns are arranged so that vehicles on the intersecting streets pass between the columns of successive bents and thus have clearance under the bridge on straight oblique lines nearly parallel to the streets. In this case the usual transverse spacing of the columns is considerably increased.

Two Views along Right of Way of New York, Westchester and Boston Ry.

The bridge over Baychester Ave. is 122 ft. long between faces of abutments on the center line of track, and is typical of the skew deck structures in the Borough of the Bronx. There are four spans arranged symmetrically with the axis of the street and tracks, and supported by the abutments and by three transverse rows of intermediate columns, one row in the center line of the avenue and the other rows on the curb lines. The columns have T-shaped cross-sections made of a 14½x⅜-in. web, four 5x3½x⅜-in. flange angles and two 15-in. flange channels with their flanges turned in, thus affording an efficient distribution of material for a compression member and having the advantage of no tie plates or lattice bars to invite climbing.

In order to provide for efficient anchorage each column has four 1½-in. anchor bolts 5 ft. long with nut bearings at both ends. The lower nut engages a steel anchor plate built into the foundation masonry. The upper end of the rod passes between a pair of long vertical distribution angles riveted to the side of the column and has a nut bearing on its upper end. The bases of the street columns are enclosed in cast-iron shields made in two pieces bolted together, which also act as wheel guards and are filled with concrete. The columns on the curb lines have the same base, but are buried below sidewalk level so that only the net section of the column is visible.

The top of the column has a horizontal cap plate on which the lower flange of the transverse girder is field riveted. Additional connection between the column and girder is provided by vertical angles and flats riveted to the column channel flanges and projecting about 2 ft. above the column tops to be field-riveted to the wide outstanding flanges of the vertical web stiffener angles of the girders. The transverse girders are kneebraced to the columns with curved, solid web brackets. The longitudinal girders are web-connected to them with their top flanges 2 in. or more above the tops of the transverse girders. The two longitudinal girders for each track are connected by the usual transverse frames and top and bottom zig-zag lateral angles and, except for their supports on the same transverse girders, form independent parallel spans.

In typical through spans the longitudinal girders are seated directly on top of vertical columns, of which there are five in each transverse bent. The bents are set on the curb lines and on the street center lines, as shown for the deck spans. The five lines of girders are 12½ ft. apart and are connected by plate-girder floor beams 26 in. deep and about 7½ ft. apart, to which the 15-in. 42-lb. I-beam stringers are web-connected 6 ft. apart. The two outer girders on each side of the center line of the bridge are X-braced by lateral angles in the panels between floorbeams, but there is no diagonal bracing between the center line of girders and the girders on each side.

The franchise in Mount Vernon required work to be commenced within 60 days, and a company force has been employed there in excavating and filling, most of the work being done with hand labor and teams, except the rock drilling, which is done with steam drills. Contracts for grading and masonry on two adjacent sections having a combined length of over four miles between 177th St. and Mount Vernon city line, were awarded on August 8, 1905, to Jas. P. McDonald, who in turn sub-let the work to J. B. Flick & Co., Kansas City. About two months were occupied in preliminary work and preparations, such as building trestles, laying tracks, etc., and in hauling the heavy equipment about three miles from the railroad to the site over country roads; since then the contractor's force has been organized and work has been progressing satisfactorily for nearly two months. About 1½ miles of roadbed have been nearly graded, two high concrete abutments with faces about 150 ft. long have been completed and work has been commenced on two more where the footings have been made, forms built and concreting is now in progress. Operations were commenced at two points about 1½ miles apart and work is in progress in both directions from each point.

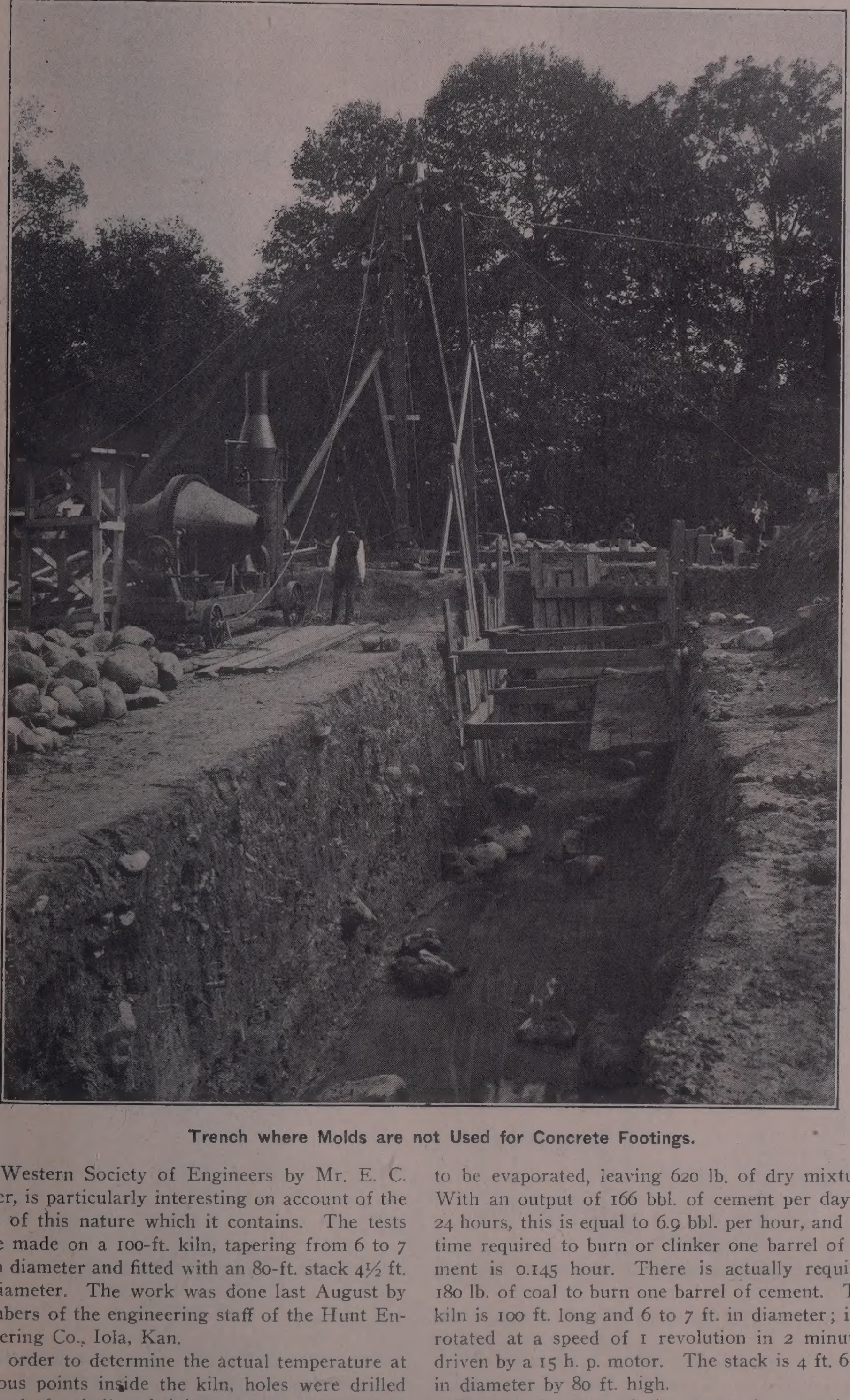
The present plant includes four standard gauge locomotives, about 60 ten-yard side dump cars, four Bucyrus steam shovels with 1½-yd. buckets, four Smith concrete mixing machines, about a dozen Ingersoll rock-drills with eight steam boilers, and a number of boom derricks operated by steam hoisting engines. The steam shovels are run from end to end of the cuts, making about half the width of a four-track excavation each time and excavating to a depth of about 10 ft. Spoil is loaded on cars on parallel tracks, which are at first located on the top of the bank alongside and for the second lift on low level tracks. The cars are hauled by locomotives to fills at both ends of the cuts. The contractor is required to complete his work in 20 months from the date of the contract. It is intended to let contracts for the next two sections of the road, aggregating about 25 miles, in January, and to let the contracts for sixteen plate girder bridges, most of them of several spans, during the current month. It is hoped to have the road to Port Chester, Throgg's Neck and White Plains in operation in 1907.

Capt. W. A. Pratt is chief engineer of the New York, Westchester & Boston Ry., Mr. George Tatnall principal assistant engineer, Mr. J. L. Crider division engineer, Mr. H. S. Putnam electrical engineer, Mr. Paul A. Kirchner structural engineer, Mr. William Barclay Parsons consulting engineer, Mr. L. B. Stillwell consulting electrical engineer, and Mr. Fred Sargent consulting mechanical engineer. Mr. John Bogart conducted the preliminary work required for the franchise, and is general consulting engineer, and Mr. Frank A. Moore is the architect for the stations. Tests and inspection of cement are made by Robert W. Hunt & Co.

The Chicago Tunnels, owned by the Illinois Tunnel Co. are now being used for the handling of coal and ashes for buildings connected with them.

Test of a Rotary Kiln.

There can be no question that at the present time the manufacturers of Portland cement are looking with steadily increasing favor on long rotary kilns. Sixty-foot kilns were formerly the standard size, 80 to 100 ft. are probably considered standard limits to-day, while there are a number of prominent manufacturers who believe that 100 ft. is the minimum limit of length if coal is to be burned economically. Very little definite information has ever been published concerning the conditions within such a kiln, and for this reason a paper on a test of a Portland cement plant, read last month before the Western Society of Engineers by Mr. E. C. Soper, is particularly interesting on account of the data of this nature which it contains. The tests were made on a 100-ft. kiln, tapering from 6 to 7 ft. in diameter and fitted with an 80-ft. stack 4½ ft. in diameter. The work was done last August by members of the engineering staff of the Hunt Engineering Co., Iola, Kan.



Trench where Molds are not Used for Concrete Footings.

In order to determine the actual temperature at various points inside the kiln, holes were drilled through the shell and lining at seven places, 16 ft. 8 in. apart, including both ends. Readings were taken every 10 seconds at each hole where the heat was intense, and elsewhere every 30 seconds. The readings were continued until the maximum temperature at each hole was ascertained. These readings show a temperature range of the gases given in the accompanying table, together with temperature range of the materials partly computed and partly observed.

Changes Observed in a Rotary Kiln.

	Distance of Hole from Feed End.						
	0	16′8″	33′4″	50′	66′8″	83′4″	Hood
Gases, Fahr. deg.	456	996	1291	1581	2031	2587	1271
Materials, deg.	95	212	....	1000	....	2496	1381
SiO_2, per cent.	14.3	14.3	15.4	13.5	17.5	21.5	21.4
Al_2O_3, Fe_2O_3	7.5	7.5	7.4	7.4	9.3	13.7	15.1
CaO	38.8	38.8	39.5	39.6	49.2	61.7	60.7
MgO	0.82	0.82	0.97	1.0	1.4	1.08	1.26
Loss on Ign.	32.0	32.0	30.7	24.6	13.1	0.2	...
SO_3	5.59	6.07	7.00	6.88	8.37	1.67	1.70
Moisture	53.0	20	..	..	..	..	..

In commenting on these results, Mr. Soper pointed out that to produce one barrel of cement of 384 lb. there is required 1319 lb. of slurry, containing 53 per cent. or 699 lb. of water, which has to be evaporated, leaving 620 lb. of dry mixture. With an output of 166 bbl. of cement per day of 24 hours, this is equal to 6.9 bbl. per hour, and the time required to burn or clinker one barrel of cement is 0.145 hour. There is actually required 180 lb. of coal to burn one barrel of cement. The kiln is 100 ft. long and 6 to 7 ft. in diameter; it is rotated at a speed of 1 revolution in 2 minutes, driven by a 15 h. p. motor. The stack is 4 ft. 6 in. in diameter by 80 ft. high.

The proximate analysis of the Iowa coal is: Volatile matter, 43.30 per cent.; fixed carbon, 30.98 per cent.; ash, 19.56 per cent.; sulphur, 6.56 per cent. By calculation from this analysis the heat value of this coal is taken at 10,094 B.t.u.

The analysis of the cement material is $CaCO_3$, 74.46 per cent.; CaO (calculated), 41.36 per cent.; insoluble, 19.50 per cent.; sulphur, 6 per cent.; ignition loss, 33.14 per cent.

The cement analysis is: CaO, 64.75 per cent.; SiO_2, 19.75 per cent.; Fe_2O_3, 6.25 per cent.; Al_2O_3, 6.50 per cent.; Mg. O, 0.89 per cent.; SO_3 1.90 per cent.

The temperatures observed were as follows: Air entering kiln from blower, 213° Fahr; air surrounding the kiln, 102°; slurry 95°; average of the kiln shell, 260°; Clinker, falling from the hood, 1381°; waste gases entering the stack, 456°; clinkering zone, 2496°.

The distribution of heat per barrel of cement was as follows: Evaporation and heating of 699 lb. of water to 456° F. waste gases temperature, 838,883 B. t. u.; in the dry mixture of 620 lb., with 461.7 lb. CaO_3 to be decomposed, 353,200 B. t. u; with 37.2 lb. SO_3 to be liberated, 70,306 B. t. u.; with 620 lb. dry mixture, heated from 95° to 1000° F. (CO_2 reduced), 112,220 B. t. u.; with 384 lb. of clinker heated from 1000 to 2496° F., 147,856 B. t. u.; with 384 lb. of clinker discharged at 1361° F. into the air at 213° F. the loss is 107,835 B. t. u.; loss by radiation from 2042 sq. ft. surface of kiln and 66 sq. ft. of hood, reduced to the unit of one barrel of cement, equals 201,256 B. t. u.; heating up air blown into the furnace with a pressure of 5.75 in. of water and with 3 in. diameter of nozzle, amounting to 3878.5 cu. ft. of air per barrel of cement burned, amounts to 6,040 B. t. u.; loss of heat by the waste gases at a temperature of 456° F. and of 2160 lb. of air heated from 102° F. amounts to 175,824 B. t. u. The combustion of Iowa coal (analysis given) requires about 8 lb. of air per pound of coal (theoretical), and allowing 50 per cent. excess of air, the consumption of 180 lb. of coal per barrel of cement requires 2160 lb. of air.

With the old kiln of 60 ft. length the waste of heat by higher temperature of waste gases, greater loss of heat in the clinker, and greater loss in evaporation and heating of the water, lead to a saving with a 100-ft. kiln, of 483,126 B. t. u., which is equivalent, under ordinary operating conditions, to about 48 lb. of coal per barrel of cement.

Further improvements can be effected by having the slurry of a temperature of 200° F., a saving of 73,194 B. t. u.; by using the air of a temperature of 450° F., a saving of 22011 B. t. u.; by the saving of a moderate stack temperature, 123,120 B. t. u.

The total savings with these improvements, using the 100-ft. kiln, as against the old 60-ft. kiln, amounts to 701,451 B.t.u., equivalent to about 72 lb. of coal, operating under ordinary conditions.

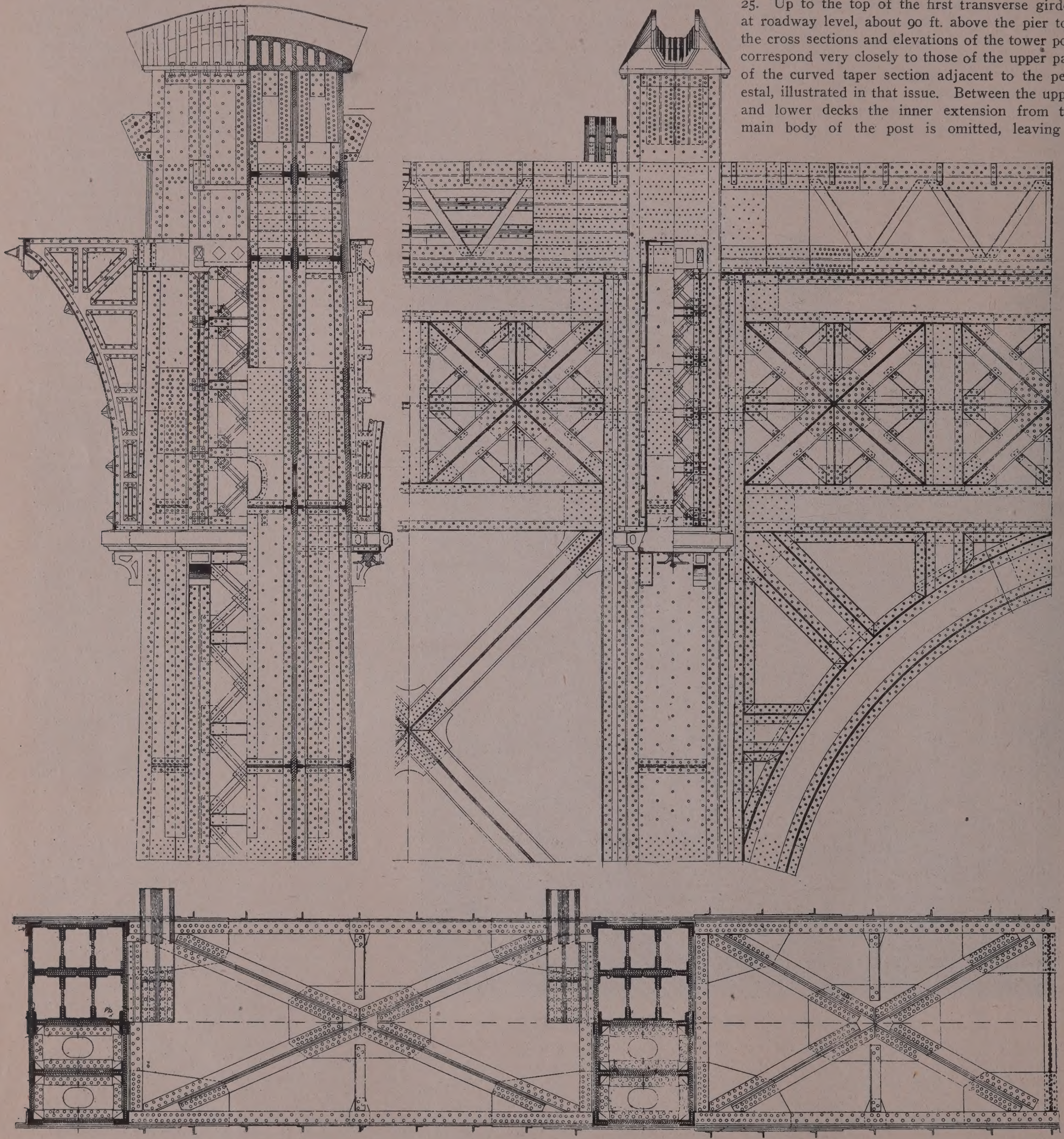
The heat supplied the kiln per barrel of cement, is given by Mr. Soper as follows: Heat produced by chemical reactions; from the CaO and Mg. O; from 248.64 lb. CaO per barrel of clinkers there are liberated 237,164 B. t. u., and from 3.4 lb. MgO per barrel of clinker there are liberated 5061 B. t. u., a total by chemical reaction of 242,225 B. t. u. From the air entering the kiln through coal feeder blow pipe, there are liberated 6,040 B. t. u.; from the gases (CO_2 and SO_2) reduced from 1000° to 456° F. there are 26,625 B. t. u.; heat from the combustion of 180 lb. of the Iowa coal, of a thermic value of 10,094 B. t. u. on the assumption that 1.5 times the theoretical quantity of air is supplied for combustion, the heat used amounts to 1,755,720 B. t. u.; total of these items, 2,030,610 B. t. u.

Assuming that certain further improvements and alterations be effected as recommended, then a further saving of 218,325 B. t. u. in the present installation, can be made, equivalent to 22 lb. of the Iowa slack coal, which will reduce the coal consumption per barrel to 158 lb. For the sake of comparison, if Fairmount, W. Va., coal be considered, this would be equivalent to 128 lb. of coal per barrel of cement burned; this is believed by Mr. Soper to be as low as can be without the installation of complicated and costly apparatus, whose utility and practicability are still to be demonstrated. The stack gases are as low in temperature as is consistent for good draft without mechanical means.

The probable action in the kilns is stated by Mr. Soper as follows: The material is heated from its entering temperature to 212° F. where the water is converted into steam, and during this process, the temperature remains constant; then the temperature rises gradually to 1000° F., where the CO_2 is given off and the temperature again remaining constant, but rises rapidly after this action to the clinkering temperature of 2496° F. Here the temperature probably remains constant a short time, and then decreases rapidly as the cooler entering gases strike it.

A point worth mentioning is that in reconstructing this plant use was made of old vertical kilns for clinker pits. The plant before reconstructing was not a paying proposition financially, because of the high cost of coke, from $8 to $11 per ton, and cost of labor due to the old methods employed. By the installation of the long kiln, Iowa slack coal at a cost of $2.60 per ton, containing a high percentage of ash and sulphur, can be used. The sulphur in the raw mixtures is about 7 per cent. and is reduced to 1.78 per cent. in the clinker. The manufacturing cost per barrel has been reduced to one-half the original amount.

Producer Gas Power for marine service has been introduced in England, according to consular reports, a 136-ft. 3-masted schooner having been equipped with 600-h.p. producer and engine.

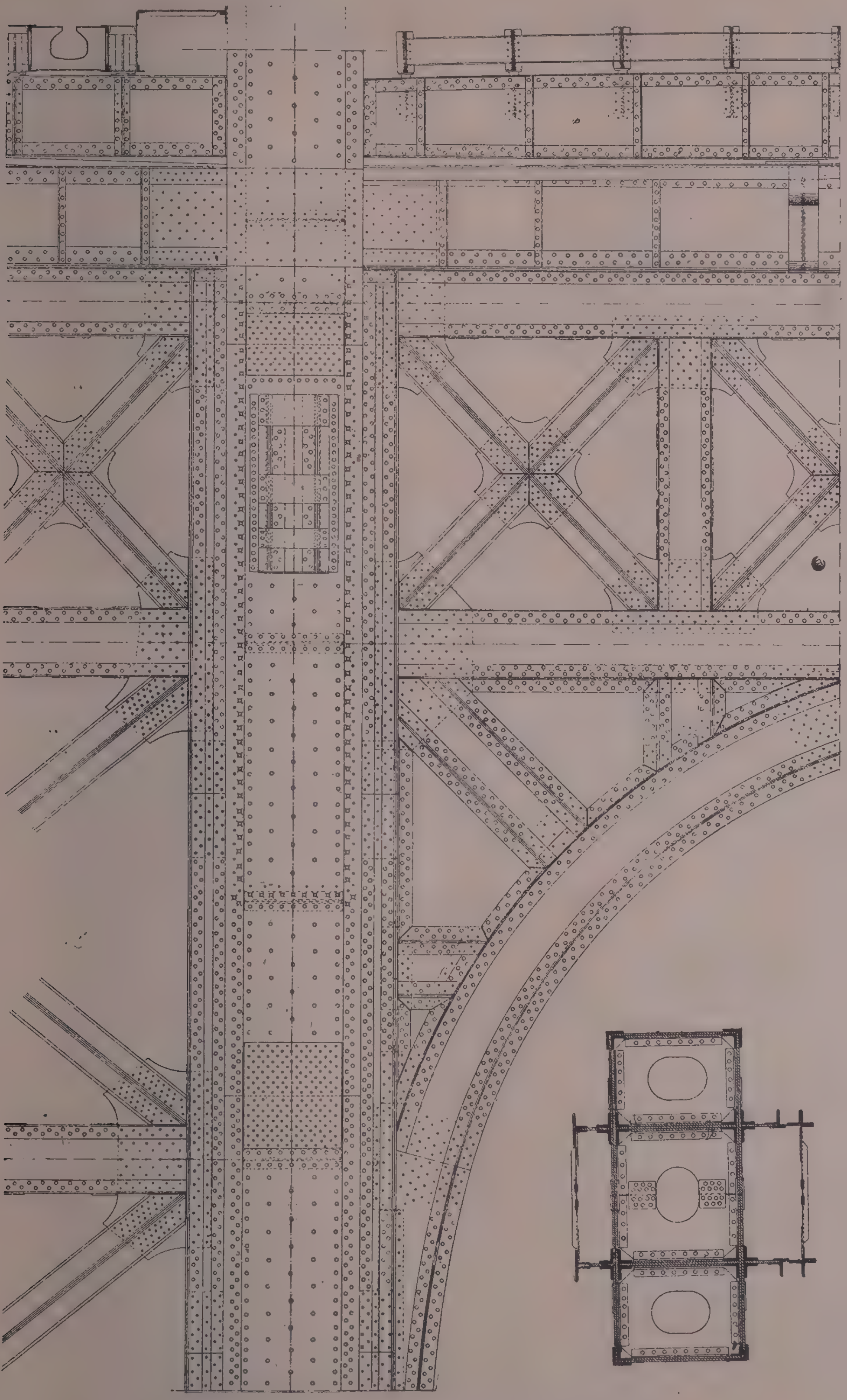


Scheme of Horizontal Bracing and Elevations of Top of Towers, Manhattan Bridge.

The Upper Sections of the Manhattan Bridge Towers.

The lower portions of the towers of the Manhattan bridge to be built across the East River at New York were described in this journal on Nov. 25. Up to the top of the first transverse girder, at roadway level, about 90 ft. above the pier top, the cross sections and elevations of the tower post correspond very closely to those of the upper part of the curved taper section adjacent to the pedestal, illustrated in that issue. Between the upper and lower decks the inner extension from the main body of the post is omitted, leaving a T-shape cross section, but above the upper deck this extension reappears and extends to the saddle, and, as in the lower part of the post, affords connection for the transverse horizontal struts and X-braces between the pairs of posts. The cross section diminishes upwards by the taper of the post, by the varying thickness of angles and plates and by the omission of some of the main angles; the horizontal diaphragms are also spaced farther apart at the upper end of the post; otherwise the design of the post is practically uniform from the saddles to a point about 40 ft. above the pedestal.

Transverse girders, braces and struts connecting the columns make a very massive construction, almost continuous, reaching, on the inner posts from about 50 ft. to about 100 ft. above the pedestal. These members consist, as shown in the part elevation, of an inner post, a curved portal strut, a horizontal lattice girder, a horizontal lateral strut and the floorbeam, all of which except the portal strut are continued across to the outside post. At this point the cross-section of the post is composed of twenty-six web and cover plates chiefly from ¾ to 1¼ in. thick, and from 41 to 75 in. wide, and four 8x8x1-in. and twenty-six 6x6x15/16-in. angles.


General Arrangement of Tower Details near Roadway Level.

Riveted to the transverse faces of the posts there are pairs of brackets with vertical webs 18 in. apart, bored to receive the end bottom chord pins of the stiffening trusses. Over the roadway the inside posts are connected by a second deep and massive transverse lattice girder with inclined portal struts as shown in the issue of July 29. The top chords of the lattice girders and plate girders between the center and outer posts, support an observation gallery, reaching all around the tower. Above this gallery the post construction is regular for about 120 ft. up to the top sections, and is divided into five 23-ft. 8-in. panels braced between the inner and outer posts so as to virtually form vertical transverse trusses of great strength against wind pressure.

The cross section varies only with the taper of the post and is built up with sixteen tapered 1-in. web plates about 4 ft. in average width, riveted together in pairs, two 56¾x1-in., two 43¼x15/16-in., two 53¾x1¼-in., four 41⅛x15/16-in., four 16x1¼-in. and four 13⅝x½-in. web and cover plates and four 8x8x1-in. twenty 6x6x15/16-in., and eight 6x6x½-in. angles.

The upper ends of the posts are very rigidly connected by a deep and massive system of transverse bracing similar to that at roadway level and occupying a total height of over 40 ft. The upper member of this system of bracing consists, between the inner posts, of two horizontal lattice girders, about 11 ft. deep and 3 ft. apart in the clear with their flanges connected by angle latticing in vertical planes. Between the inner and outer posts two more duplicate girders occupy most of the space between the upper and lower ones in the same planes as those already described and serve to equalize lateral stresses from the main cables. The upper ends of the webs in the top sections of the posts are reinforced with short plates and vertical angles and are faced to bearing, without cap plates, for the cast steel saddles which are secured by bolts through outside horizontal flange angles. Large riveted brackets with curved outlines project from the faces of the columns and carry ornamental cast iron paneling on a riveted framework or furring which encloses and conceals the top struts and gives the effect of a cornice. The saddles are enclosed by ornamental cast-iron caps above which there are cast-iron finials surmounted by cast-iron globes.

Both upper and lower decks are carried on pairs of transverse plate girders field-riveted to the tower posts through vertical end flange angles, the webs of the girders being 5 ft. apart in the planes of the main transverse post webs. The girders for the roadway and for the trolley tracks are 3 ft. deep with 6x6-in. flange angles, those for the elevated railroad tracks are about 16 ft. in the clear above those for the trolley cars, between the inner and outer posts, and have 40½-in. web plates and 6x8-in. flange angles. The webs of the girders in all the different pairs are connected by 15-in. longitudinal I-beams in the planes of the track or roadway stringers, which have beveled cast blocks on their top flanges in the center to receive the stringers at a grade of 3.1 per cent.

The balcony, over the elevated railroad tracks, is about 22 ft. wide and 108 ft. long, transverse to the bridge axis, enclosing the tower posts. It is supported on two lines of main transverse plate girders 5 ft. apart in the planes of the main transverse webs of the posts, by riveted brackets on the posts and by plate girder cantilevers 9 ft. long from the transverse girders. The buckle plate floor is carried on 21-in. girders transverse to the bridge axis and is stiffened by single panels of X-bracing between the inner and outer posts, each brace having an I-shape cross-section made with a 14½x⅜-in. vertical web plate, two 6x3½x13/16-in. angles and one 18x⅞-in. cover plate in each flange.

At an elevation of 127.5 ft. above mean high tide each outer post is enclosed by a curved horizontal framework of radial girders which projects beyond the post center 21 ft. 8 in. transversely and 26 ft. longitudinally and reaches with a diminishing width to the inner post. It is bounded by a double-web fascia girder, which with the riveted balustrade forms an architectural continuation of the cornice and supports a number of riveted columns with curved outlines which carry the girders for a corresponding sidewalk platform at the main floor level about 11 ft. above. The outer faces of the outer posts are provided with ornamental curved hoods or projecting roofs above the sidewalk platform, about at the level of the top chords of the stiffening trusses. These hoods have a clear span of about 20 ft., a rise of 8 ft. and project 10 ft. from the face of the post, thus making a sort of permanent awning and affording protection from sun and rain. They are supported on riveted curved brackets and have a ribbed segmental cast iron surface.

The bridge is being constructed under the direction of the Department of Bridges, New York City, Mr. George E. Best, commissioner, Mr. O. F. Nichols chief engineer, and Mr. R. S. Buck consulting engineer. The Pennsylvania Steel Co. is the contractor for the steel superstructure.

British Standard Specifications for Cement.

The first attempt to standardize cement tests and testing in the United States was made by the American Society of Civil Engineers in 1885, when a committee of its members was appointed to suggest uniform methods of conducting such tests. In 1897, the Society appointed another committee, which reported in 1903. The American Society for Testing Materials took up cement specifications in 1901, and three years later adopted its now well-known standards. All this work has been done under considerable difficulties and with little outside assistance, although the U. S. Geological Survey is now co-operating in the work of research on which standardization should be based. In Great Britain the progress in standardization has been very different, and its history is so interesting and instructive that an abstract of a paper on the subject, presented at the last meeting of the American Society for Testing Materials by Mr. Robert Lesley, Assoc. Am. Soc. C. E., is given below:

The record shows that the British Committee on Cement was appointed at a meeting of the Main Engineering Standards Committee on March 27, 1903. The first meeting was held June 12, 1903. Twelve meetings were held, and the specification was passed in its final form November 23, 1904, and approved by the Main Committee on December 8, 1904. In considering the promptness of this work, and in view of the general work of the Engineering Standards Committee in England, it is to be noted that this great body has the support not only of the British Government, but of a number of the governments of the English colonies. It is to be noted also, that this support was not sentimental, but an actual money support which enabled the various committees to do good work, and to put out promptly specifications and volumes of reports in the best form. Another interesting fact in connection with this British specification is that the government is actually represented by a number of its officers on the committee; the chairman, Mr. Matthews, representing the Crown Agents for the Colonies; Mr. Colson, representing the Admiralty; Mr. Fitzmaurice, the London County Council and Mr. Lyster, the Liverpool docks. Another point to be noted is that while engineers and experts are on the committee, and the manufacturers of Portland cement are well represented, the large contracting firms in England whose names are world-wide for good work have also been associated in the preparation of the standard specifications. The sentimental feeling that interest agitates those who prepare specifications did not prevent the British Engineering Standards Committee in recognizing the producer and the user of cement, as well as the engineer who stands between producer and consumer.

The British specification is shorter, more compact and embodies in four large pages of printed matter, covering a series of articles numbered from 1 to 12, what 32 pages are taken to describe in the American specification. The specifications embody in the one case, 12 articles, in the other 2 articles, which latter in turn cover 76 more. This condition of specifications in the United States is due to the embodiment in and under the standard specifications of the American Society for Testing Materials, of the progress report of the American Society of Civil Engineers and the report of the New York section of the Society for Chemical Industry. When, however, the two specifications are again compared, it will be noticed that the British specification covers in its 12 articles all there is to be said on both manipulation of tests and specification for tests, but that it omits entirely all reference to chemical analysis, which is evidently not considered to belong to a standard specification for Portland cement. In comparing the two specifications, therefore, it is necessary to consider the reports on methods of manipulation and standard specifications, omitting the methods of analysis.

Without going over the entire methods of manipulation required by the progress report of the American Society of Civil Engineers, or dealing with those parts of the British specification which have to do with methods of manipulation alone, it may be stated in a general way that on the first item of the definition of Portland cement, the British specification suggests both water and sulphate of lime as materials which may be added to retard the setting and covers both in its specification, limiting the amount in either case to 2 per cent. In the American specification, it will be noted that any addition, subsequent to calcination, is limited to 3 per cent.

On specific gravity, both specifications practically agree to 3.10, but the English specification raises the amount to 3.15 where the cement is sent direct from the mill to the laboratory in tightly sealed packages.

On fineness, there is a material difference in the screens used, and it may be stated that the American specification, which has 8 per cent. on a No. 100 (10,000 mesh) sieve and 25 per cent. on a No. 200 (40,000) mesh sieve would require a finer grinding than the British, which has 3 per cent. on a 5,776 mesh sieve, or 22½ per cent. on a sieve of 32,400 meshes.

In the matter of setting, the specifications are again at variance. The American specification requires the cement to develop initial set in not less than 30 minutes, but must develop hard set in not less than one hour, nor more than ten hours. The English specification recommends three distinct grades of setting time, designated as quick, medium and slow. The first is not less than 10 minutes nor more than 30 minutes; the second not less than one half hour nor more than 2 hours, and the third not less than 2 hours nor more than 5 hours. While these grades of time of setting are recognized, each of which will have a material bearing upon the tensile strain of cement, yet the British specification, in the matter of tensile strength has but one series of limits, namely: Neat cement; 7 days, 400 lb.; 28 days, 500 lb. Mortar of 1 cement and 3 sand, 7 days, 120 lb.; 28 days, 225 lb.

The American specification on the other hand, while not recognizing different classes of cement, so far as the time of setting is concerned, does recognize different strengths in tension, and has what the British specification has not, a 24-hour test which may possibly in some quarters be considered superfluous for Portland cement. The American requirements are: Neat cement, 7 days, 450-550 lb.; 28 days, 550-650 lb. Mortar of 1 cement and 3 sand, 7 days, 150-200 lb.; 28 days, 200-300 lb. These are all higher than those of the British specification, which is no doubt due to the fact that there is more rotary cement manufactured in the United States than possibly anywhere in the world.

Interesting, however, is the difference in the matter of gain in strength at longer periods, a new requirement which has only come into cement testing since the introduction of the Rapid Transit specification in New York. In the United States, in view of the fact that the matter has not been thoroughly settled, it is held broadly that no cement shall show retrogression. In the English specification, however, this question of the increase of strength between the 7-day and 28-day periods is graded according to the initial strength shown by the cement at the 7-day period, which seems to be a very fair method of determining increased strength between the periods stated. In that specification, a cement showing 400 to 450 lb. at 7 days is to gain 25 per cent. in 28 days; 450 to 500 lb., 20 per cent.; 500 to 550 lb., 15 per cent., and all over 550 lb. at 7 days, an increase of 10 per cent. at 28 days. This can readily be seen to be a very fair view of the subject, as a cement that pulls 600 to 700 lb. at 7 days will have to increase very many pounds in tension to acquire the strength to show 25 per cent. increase between the 7-day and 28-day periods, while a 10 per cent. increase would be a much more reasonable figure.

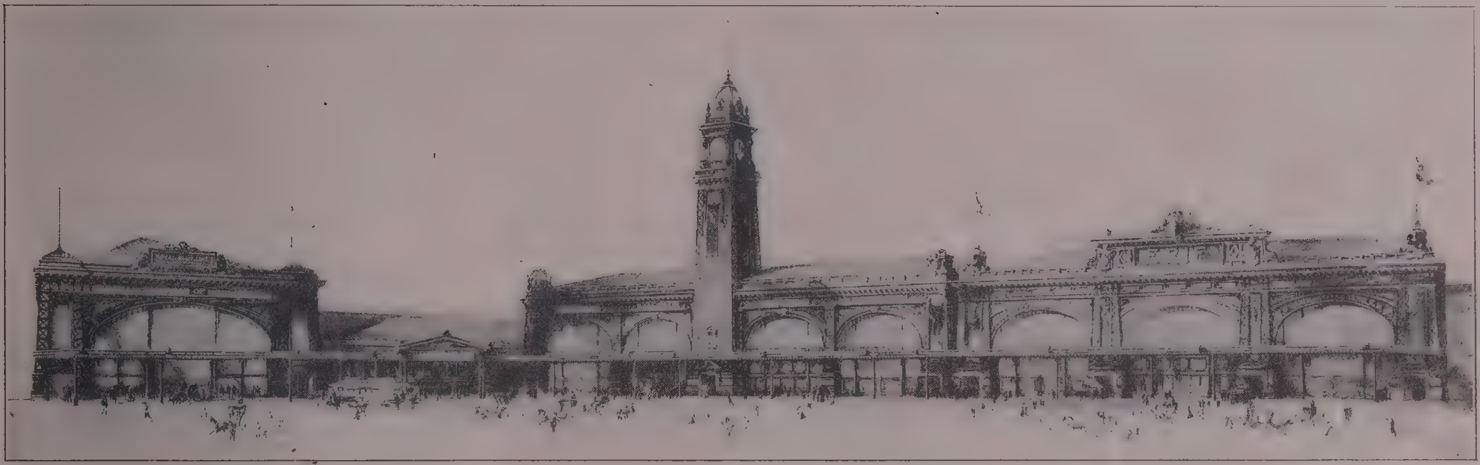
The great and salient difference between the two specifications is that governing the test for constancy of volume, or what are known technically as accelerated tests. In the American specification there has been adopted the hot and cold water tests prescribed under the German normal test, which have been in use so successfully for many years, and have supplemented them by a steam test after the cement has set for 24 hours, consisting of exposing the pat in an open vessel to steam rising from a body of water beneath. The British have adopted what is known as the Le Chatelier test, which so far has not been generally adopted outside of France. This is the part of the specification which up to date has attracted most criticism, by reason of possible inexperienced operators not producing similar results, with similar cements under similar circumstances.

The chemical requirements of the cement differs in the two specifications as follows: In the American specification 1.75 per cent. of anhydride sulphuric acid is permissible, while in the British specification the limit is run up to 2.5. In England 3 per cent. of magnesia is allowed, as against 4 per cent. in this country. Insoluble residue in England is limited to 1.5 per cent. Another interesting thing in the English specification is, that there shall be no excess of lime; that is to say, the proportion of lime shall not be greater than is necessary to saturate the silica and alumina presented. Of course, this would be covered by the analysis of cement described in the methods of manipulation of tests of the American Society of Civil Engineers and the methods of analysis of the American Chemical Society, which are part of the American specification.

It is interesting to note that while the standard American specification has so far stood fire very well, and even its makers could only suggest unimportant typographical corrections at their last meeting, the British standard specification has not been so fortunate. From several quarters there has been some little criticism on the accelerated test, accompanied by statements of different results on the same sample. There has also been some other unimportant criticisms on chemical composition. Whether the difference in mental attitude to the new specification in the two great English speaking countries is due to the respective national characteristics of their people, is still to be determined. Both specifications betoken to Mr. Lesley good, careful thought, and work conscientiously done.

Mechanical Plant of the New 23d St. Ferry Terminals, New York.

As a part of the important developments in the transportation facilities at New York of three of the trunk railroads having their main terminals in Jersey City and Hoboken, new ferry houses have been built at West Twenty-third St., Manhattan, for better communication with the shopping, hotel and threater districts of that borough. These ferry houses belong to the Erie R. R., the Delaware, Lackawanna & Western R. R., and the Central Railroad of New Jersey, and front on an open space or plaza in Twelfth Ave. between Twenty-third and Twenty-second Sts. The new structures are of structural steel throughout and have been so designed as to harmonize the architectural features of their entrances. They have loading platforms on two levels, so that passengers can enter and leave both decks simultaneously, thereby greatly increasing the facility with which the traffic is handled. The construction details of the new buildings are in general similar to those of the Central Railroad of New Jersey terminal, which were described in The Engineering Record of Jan. 7, 1905.



General View of the Three New Ferry Terminals at West 23rd Street, New York.

The heating and lighting of the three new terminals, a difficult problem in view of the peculiarities of the service, is to be handled from a central power plant in the terminal of and operated by the Lackawanna R. R., which occupies a central position in the group. The distribution of both steam and electrical mains is thus simplified, the Erie terminal adjoining on the north and the C. R. R. of N. J. terminal on the south. The Lackawanna terminal is a three-slip ferry house, occupying a plot 234 ft. in depth, with a frontage of 227 ft. on Twelfth Ave. and 272 ft. on the river front, the first floor layout being reproduced in the accompanying plan. It is largely an open structure, the enclosed portions embracing the waiting-rooms, ticket offices, etc., on two floors in the center of the building, for the main ferry to the railroad terminal at Hoboken, and similar facilities but of smaller size at the south side of the building for the ferry to Fourteenth St., Hoboken. The former section has two ferry slips, one on either side, and the latter the single remaining slip.

The location selected for the power plant is at the river side of the building, where a space 31 x 68 ft. was available at the rear of the cab stand. This was divided into two rooms, 43 and 25 ft. in size, the former accommodating the boilers, and the latter the electrical plant. This portion of the building which, like the remainder of the structure, is carried on piling over the water, was constructed separate from the main section of the structure, so that the rebound of the ferry boats in making landings at their slips will not affect the machinery. The piles under this section were driven on close centers, about 24 in., and with great care to secure a stable foundation. The piling is surmounted by a heavy flooring of creosoted plank laid in three diagonal courses, while the flooring proper is a bed of concrete 36 in. thick, which forms the solid mass necessary for stability to the machinery equipment. All the machine foundations were built direct in the concrete and the anchor bolts were located by template in advance as required.

Boiler Plant.—The boiler plant is of interest on account not only of the extremely small space available for a plant of this size, the equipment for the three new ferry terminals having been installed in the space formerly intended for a plant to serve the Lackawanna terminal alone, but, also, the location of the equipment in a section of the structure supported on piles over the water so that a minimum of weight was highly desirable. The result was the selection of the Worthington water-tube boiler with a full steel casing to the entire exclusion of brickwork, by means of which a minimum of weight in boilers was possible. This boiler also offers the advantages of extreme compactness, each occupying a floor space of 10 x 12¾ ft., with over-all height of 13 ft.; this is an important advantage in view of the restricted space available, enabling the entire boiler plant of 800 h.-p., rated capacity, together with all auxiliaries, to be accommodated in a floor space of less than 1,200 sq. ft., or 1.5 sq. ft. per rated horse power.

The equipment consists of four 200-h.-p. Worthington side-fired, marine-type boilers, operating at 150 lb. pressure, which were supplied by the New York Safety Steam Power Co. Each boiler has 1,800 sq. ft. of heating surface and 53 sq. ft. of grate area to permit of a comparatively low combustion rate for the capacity, the ratio of grate to heating surface being 1 to 34. There are 25 inclined tube sections, each of which has eight 3-in. tubes, 10 ft. long, expanded into headers on either end. The central steam drum of each unit is 42 in. in diameter by 11 ft. long, with 7/16-in. shell and "bumped" heads of ½-in. plate, while the two side mud drums to which the lower tube headers are connected are each of 10-in. extra strong wrought-iron pipe. For the furnace the special form of grates of the Parson Mfg. Co. are used, for burning low-grade, fine anthracite fuel with automatically regulated forced draft. In this system the draft is automatically controlled by a regulator actuated by the steam pressure, which turns on the steam jet blowers or cuts them out throughout a small range of pressure variation. Each boiler has a 2½-in. blow-off connection, with a special Fairbanks asbestos-packed angle valve and a gate valve in tandem, which discharge into the river below.

The products of combustion are removed from the boilers by a steel stack, 66 in. in diameter, which rises to about 65 ft. above the grate level. The stack is supported by a bracket over the boiler feed pumps forming a part of the structural framework of the building, and is concealed on the exterior of the building by an ornamental tower, rising about 10 ft. above the roof, which harmonizes pleasingly with the exterior architectural treatment of the river front of the structure. Connections are made from the boilers by means of a trunk flue, 30 x 48 in. in section, which extends from the base of the stack over the boilers with branch connections to each. These flues are suspended from the ceiling, high above the boilers for ample head room, by special iron hangers, and are covered with 1 in. of asbestos air-cell fireboard, supplied by the New York Asbestos Co., and then surfaced with ½ in. of plastice asbestos cement. The branch flue to each boiler has a balanced damper for cutting it out when desired, and the main flue is fitted with a special balanced butterfly damper mounted on ball bearings, which is operated by a Ford damper regulator for automatic control of the draft.

The boiler feed system consists of two feed pumps and a pump governor receiver, and is designed to utilize the condensation returned from the heating system when available and city water to make up for wastage. The feed pumps are 6 x 4 x 6 in. Worthington duplex pumps, brass mounted, and are equipped for pumping hot water. They are both set so as to work on a single Worthington receiver and pump governor, both taking suction from the receiver through 3 in. suction lines with gate valves. The steam supply for the pumps is taken through a reducing valve for a means of adjusting the pump operation. In addition to the drip return connection to the pump governor receiver, there is also a direct city water connection for emergency.

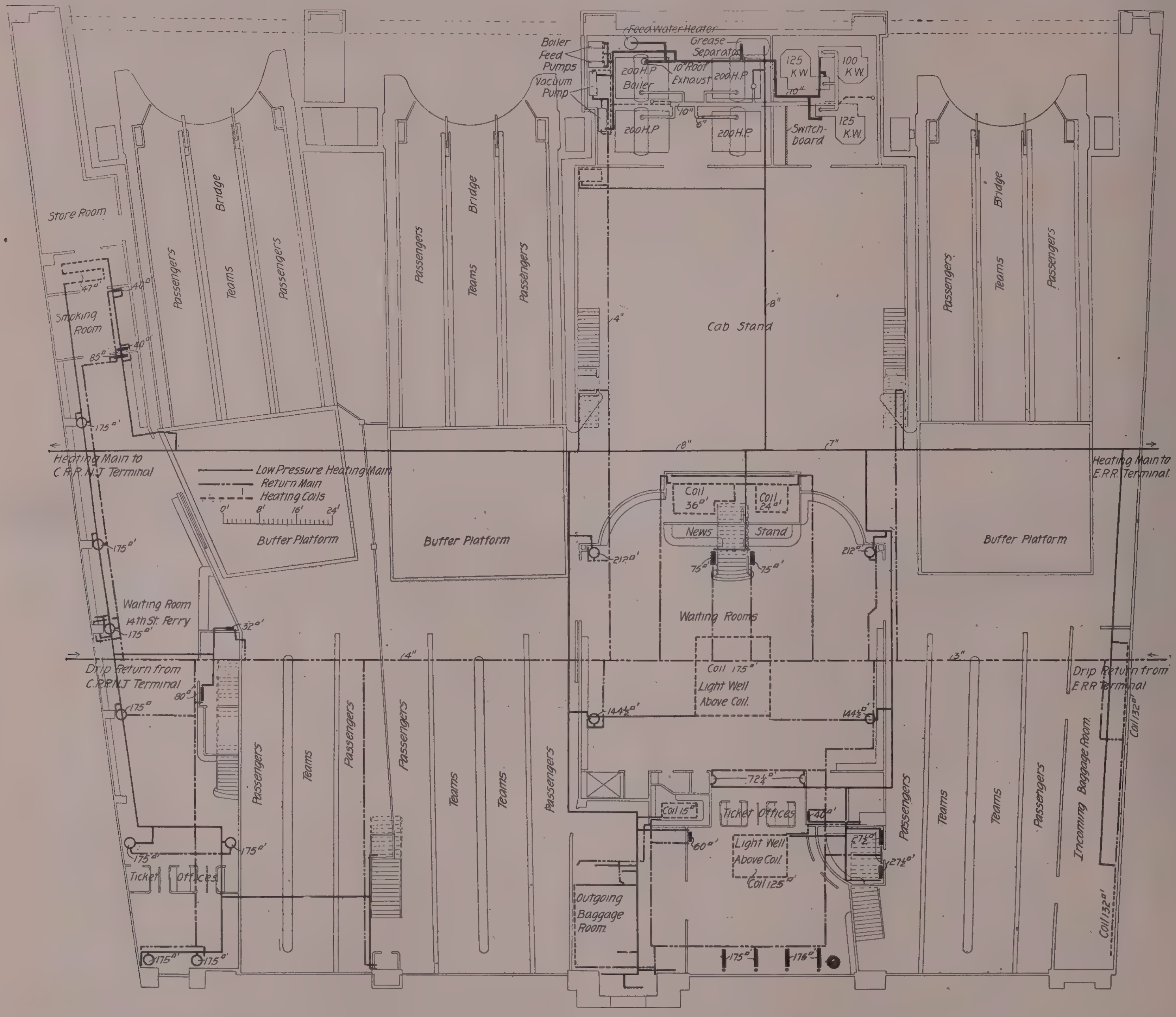
The feed piping system consists of a 3-in. delivery main leading from the pumps to the overhead with 2-in. branches to each boiler. The heater is by-passed while each boiler feed branch, which is of brass pipe and fittings, has two stop valves with the check valve between. All the pipes, fittings, etc., are of extra heavy pattern capable of withstanding 300 lb. per sq. in., although excess pressure will be prevented by a relief valve on each pump set for 150 lb. The feed water heater is a Wainwright corrugated tube heater of 600 h.-p. capacity, having 54 1½-in. brass corrugated tubes and a 22x112-in shell.

The steam piping system consists of a 10-in. header extending between the boiler and engine room, from which a 6-in. connection is made to each boiler through long-radius bends. Steam is distributed to the units in the engine room by a 9-in. cross-header with 5-in. branches to each. There are two live steam connections to the heating mains, one through a 4-in. Kieley pressure-reducing valve and the other a valved 4-in. connection by-passing the former. The exhaust system has a 10-in. main leading from the engine exhaust connections into the boiler room, where connection is made first to the muffler tank and grease separator for the heating supply, second through a 7-in. branch to the feed-water heater, and thence through a Kieley back-pressure valve to an Abendroth & Root exhaust head above the roof. The bottom of the exhaust riser is extended down to form a condensation pocket; this and the pockets in the high-pressure header in the boiler and engine rooms are drained by steam traps to the pump receiver. All of the piping is protected by 85 per cent. moulded magnesia covering, with 10-oz. duck over it.

Heating.—The heating system of the buildings is supplied with exhaust steam at about ½ lb. pressure, and is designed for the Webster system of steam circulation. The supply is taken from the exhaust steam main through the grease separator to an 8-in. distribution main, 4-in. live steam connections being made from the high-pressure system for make-up and emergency service, as above noted. The grease separator, which was built by the Baldwin Engineering Works, contractors for the steam plant, is the standard water-surface separator of this company, with automatic overflow for entrapped oil, and serves to remove entrained lubricating oil from the steam. From this separator the 8-in. supply main leads out from the boiler room and beneath the ceiling to a cross distributing main near the center of the building, from which the various branches are taken off to the radiators and heating coils, as indicated in the accompanying plan of the building. From this cross main extended, the heating connections are also taken off at either side for the supply of the adjacent ferry houses.

The heating mains gradually drop in the direction of the flow of the steam to their ends, where there are the usual relief pipes with Webster vacuum traps on each. The radiator connections are taken, where possible, from the top of the heating mains so that the condensation in the mains is carried to the relief pipes. For the direct radiation, both the Bundy narrow-loop plain and circular radiators, and pipe coils are used, the latter, however, being used principally under skylights, and for wall radiation in toilet rooms, etc. The distribution of the heating surface upon the main floor is indicated upon the plan. Radiator connections are made as follows for the various sizes of radiators: 50 sq. ft. and less, 1 in.; from 50 to 100 sq. ft., 1¼ in.; from 100 to 200 sq. ft., 1½ in., and over 200 sq. ft., 2 in. Each radiator has from two to four of the Webster vacuum traps on its return end to return the condensation as it accumulates, which ensures as nearly perfect operation as is possible.

The drip return system is similar in general arrangement to the system of heating mains, but is in general carried beneath the floor of the building, leading from all of the Webster relief traps to a main 4-in. cross line or header which connects directly with the vacuum pumps in the boiler room. This system serves to remove the air and condensation from the radiators and heating mains, two Knowles 8 x 10 x 12-in. vacuum pumps automatically maintaining a vacuum of 6 in. in the return lines. These pumps in duplicate are controlled by a Webster diaphragm valve to operate when the vacuum drops below 6 in. Each is capable of taking care of the air and condensation which will accumulate in this system of about 15,000 sq. ft. of radiation surface. Their discharge leads to a small elevated tank with a vent pipe leading out through the roof, which acts as a separator, permitting entrained air to escape; the condensation drains therefrom directly to the pump governor receiver from which it is fed to the boilers as fast as it accumulates. Make-up water for maintaining the water line



Plan of the 23rd Street Ferry House of the Lackawanna Railroad, Showing Power Plant and Heating System.

in the boilers is added from the city water supply directly to the separator tank.

Power Units.—The electrical generating equipment consists of three direct-connected engine-driven units, two of which are of 125-kw. capacity and the third a 100-kw. set. The engines are the Fleming horizontal side-crank enclosed engines, built by the Harrisburg Foundry & Machine Co., and are of the single-expansion type for operation with a back pressure from the heating system. The two larger machines have 16 x 15-in. cylinders and operate at 250 r.p.m., while the 100-kw. engine has a 15 x 14-in. cylinder and runs at 270 r.p.m. Close regulation is afforded by the Harrisburg centrally balanced centrifugal-inertia governor. The moving parts have splash lubrication. The cylinders are protected from water by Wright steam separators above the throttle valves, which are drained by Kieley traps. A convenient engine room arrangement was secured by locating the exhaust pipes in trenches in the concrete floor, which are covered with checkered iron floor plates.

The selection of the sizes of units, namely, two of 125-kw. and one of 100-kw. capacity, was due to an operating condition which is peculiar in that a rather large day load is to be carried, so that it was necessary to install a larger size of minimum unit than usual. The day load consists of a large proportion of the interior lighting and also a considerable motor load. The generators are engine-type multipolar machines, built by General Electric Co., and deliver at 120-volts upon the two-wire system. They are over-compounded about 2 per cent. for close regulation and are designed for heavy overload capacities.

The electrical equipment is controlled by a six-panel switchboard. It has three generator panels, one a recording meter panel and the other two for distribution circuits. The generator panels are equipped with Weston instruments, I.T.E. circuit breakers and main switches, rheostats, etc., necessary for their control. The meter panel contains in addition to ground detectors, etc., three Thomson recording wattmeters for the measurement of the current used in the three terminals, all of which is recorded for the proper distribution of the station expenses of operation between the three companies. From the feeder panels there are two main feeders which lead out, one to the C. R. R. of N. J. ferry house and the other for the new Erie terminal, in which small switchboards will control the local circuits. For the local service in the Lackawanna terminal there are 14 circuits leading out from the distribution panel.

The motor equipment provided for comprises two Otis electric elevators, both of large size and operated by 25-h.-p. motors, and motors for operating the bridge approaches to the ferry boats to compensate for the varying levels due to the tide; for the latter purpose, a 5-h.-p. motor is used. An interesting equipment has been installed at the C. R. R. of N. J. ferry slip for assisting heavily loaded teams in ascending the incline from the boat at low tide, consisting of a motor-driven winch with sufficient rope to reach on to the boats; this motor is of 20-h.-p. capacity. Additional motors will be installed for the operation of fog-bell ringing equipments. A source of heavy load lies in the large electric signs used for night advertising of the various terminals. For the latter a novel form of construction was introduced by the electrical contractors, involving a removable copper hooding or casing, which covers the lamp sockets, wiring, etc., and forms the outlines of the 5-ft. letters of the signs; the contour of the hood is such as to most effectively protect the lamps and wiring from the rain and weather, yet without hermetically sealing them or rendering them difficult to get at for inspection.

An interesting feature of the auxiliary equipment of the terminals is a system of electric clocks by which uniform time is shown in all parts of the buildings and in the tower. This system consists of a large, accurate pendulum-regulated master clock of the electric self-winding type, from which a number of secondary clocks and the tower clock are operated in synchronism electrically, so that minimum attention is required in order to maintain uniformly accurate time throughout the terminals. The master clock, which is located in the Lackawanna terminal house, has a self-winding attachment by which partial rewinding of the mainspring occurs every minute as long as the electric current supply is available, so that a uniform tension is always maintained in the spring with obviously favorable results in the clock's operation, while the necessity of winding by hand is entirely eliminated. The master clock has a mercurial-compensated pendulum weight, and the results of operation have shown, since the system was installed early in the year, a variation of not over 5 seconds per month.

The secondary clocks, of which there are several distributed throughout the waiting rooms and principal sections of the buildings, are connected on a series circuit from the master clock contact mechanism, which the latter closes regularly once per minute. The secondaries have simple magnet-operated movements by which they are advanced in one-minute jumps at each closing of the circuit, and thus in absolute synchronism with the master clock; a special feature of the secondary movement prevents the hand from advancing more or less than one minute at each closing of the circuit, no matter what the variation in strength of the current may be. The tower clock secondary involves a more complicated mechanism, as time indications are provided for on four dials, 8 ft. 6 in. in diameter, with minute hands over 5 ft. long. The hands on the four dials are gear-driven by a small electric motor, which is operated from the master-clock contact closing device, but on a separate circuit from the secondary clocks within the building; this motor is set to automatically move the minute hands exactly one-sixtieth of a revolution at each contact. Current is supplied for the operation of the self-winding mechanism of the master clock, the operation of the regular secondary circuits and of the tower clock motor, by 24 cells of the Excelsior closed-circuit type of primary battery. The battery is of 300 ampere-hour rated capacity, but as this rating is for heavy closed-circuit work, while in this service current is drawn from it for only about one-half second of every minute, a service equivalent to over 450 ampere hours is obtained, so that the clock system is expected to operate for fully two years without further attention. This system of clocks was installed by the Standard Electric Time Co., Waterbury, Conn.

The entire steam plant, including the heating system of the Lackawanna and Erie houses, was designed and installed by the Baldwin Engineering Co., New York. The electrical generating equipment, switchboard, wiring and electric sign work was installed by Peet, McAnerney & Powers, electrical contractors, of New York. The heating system in the C. R. R. of N. J. terminal was installed by G. A. Suter & Co., this portion conforming closely in detail to the equipment of the system in the Lackawanna terminal, except that in addition the Johnson system of thermostat control is used.

AN OZONE PLANT of the Schneller type has recently been installed at Ginneken, Holland. According to the "Bulletin" of the Belgian Electrical Society, the electric current is first raised from 100 to 65,000 volts by a special transformer of 16-k.w. capacity. There are twelve ozonizers, ten being in use at a time to sterilize about 5,300 gal. of filtered water.

Sewer Construction in Brooklyn.

The provision of an adequate sewerage system in the borough of Brooklyn of New York City is complicated by a number of inland districts which are but slightly above tide-water elevation and are usually surrounded on three sides by higher ground. Some of the trunk sewers leading to tide-water outlets from the higher ground further inland have to be carried across these districts, and then through higher ground again to the East River, or New York Bay. The city has been greatly built up and much asphalt pavement has been laid since the original sewer system was built, with the result that many of the low districts are more or less completely flooded by every rainstorm. A number of large relief sewers have been constructed to carry the storm-water flow to tide water by shorter routes, and much reconstruction of the existing sewers has been carried on to improve the conditions in other ways.

The flood damages have been particularly heavy in one of these low districts in the northern part of the borough near the head of a short canal connected with Newtown Creek, a tidal inlet from the East River. Three large horseshoe-shaped trunk sewers, one equal to a 4.5-ft. circular section, the second to a 6.5-ft., and the third to a 10-ft. circular section, join at the intersection of three streets near the center of the district, and continue in a sewer equal to a 12-ft. circular one to an outlet in the East River, about 2 miles from their junction. The area surrounding this junction has been frequently flooded by back water in the last few years, so that provisions to carry the storm-water more directly to an outlet at tide-water have been required.

An old 10-ft. brick sewer extending diagonally across the streets containing the present 4.5 and 10-ft. sewers, had its outlet in the canal. This outlet is about 130 ft. from the point where the line of the old sewer crosses the 4.5-ft. one and about 1,200 ft. from its crossing of the 10-ft. sewer. The old sewer has been abandoned for many years, as the canal is a dead end and there was no way it could be flushed, except by the flow produced in the old sewer by storm water. The street in which this sewer was laid had also been closed and the city was required to purchase the control of the old sewer beneath it. Connections have been made between the latter and the 4.5 and 10-ft. sewers which will divert the storm-water flow from these two sewers through it into the canal. The improvement of the grade of the more recently built 10-ft. sewer, from its storm-water relief connection leading to the canal to the junction of the three sewers, which are continued in the 12-ft. sewer, has also been undertaken. This storm-water connection is about 1,500 ft. from that junction. The grade of the 12-ft. sewer will also be improved for about 1,000 from the junction of the three sewers which discharge into it.

At the point where the 4.5-ft. and the old 10-ft. sewer intersect the invert of the smaller sewer is 4.5 ft. above the invert of the larger one. The tops of the arches of the two sewer barrels were at nearly the same elevation. The arch of the old sewer had been removed the width of the new one when the latter was built, and the new sewer carried across the old one on five 10-in. I-beams supported at the ends on the brick sidewalls of the old sewer. The two sewers were connected by removing the sidewalls of the small sewer the width of the larger one and constructing a groined relieving arch spanning these side openings in the small sewer barrel. That part of the invert of the small sewer across the span of the large one was also reconstructed of reinforced concrete and the old I-beams removed. The invert of the small sewer has a depth of 9 in. at the center below its springing lines and is 8.5 ft. wide, with a capacity below those lines sufficient to carry the dry-weather flow. The sewage flow will thus be carried across the old sewer, while the storm-water flow rises above the edges of the invert and overflows into the latter, which carries it to the canal.

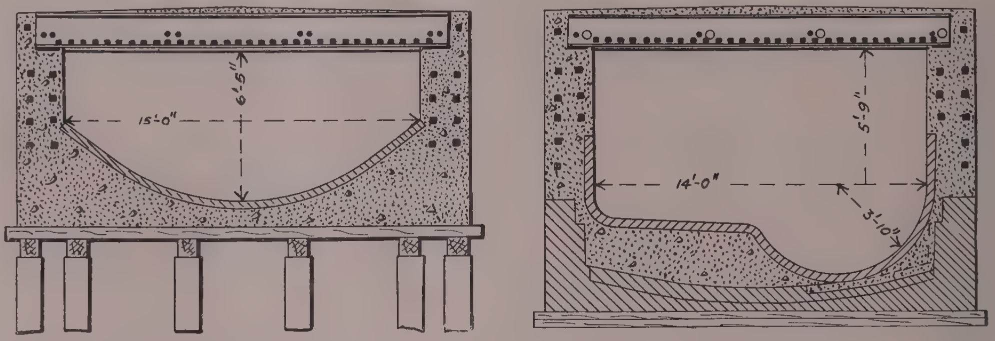
The portion of the invert built in concrete is 13 ft. long, 2 ft. longer than the width of the old sewer at that elevation, and is extended 1 ft. into the brickwork of the sewer barrel at each end, where its only support is obtained. It is built of 1:2:4 concrete and heavily reinforced with ½ and ⅞-in. corrugated bars, made by the St. Louis Expanded Metal Co. A transverse and a longitudinal row of the ½-in. bars is placed 6-in. on centers 2 in. below the top surface, with a transverse and a longitudinal row of the ⅞-in. bars, 6 in. on centers 2 in. above its lower face.

The arch of the lower end of the old sewer between the canal and the intersection of that sewer and the 4.5-ft. one was formerly above the top of the ground, the top of the arch at the bulkhead line of the canal being more than a foot above the established grade of the dock at that point. The last 100 ft. of the old 10-ft. sewer has been entirely removed and a flat-top, reinforced concrete section, which increases in width and reduces in height until the upper surface of its top is 1 ft. below the grade line of the dock, has been built in its place. This reinforced-concrete section is built on transverse rows of piles, the rows spaced 5 ft. on centers. The piles are capped with 10 x 12-in. longitudinal timbers, floored over with 6 x 12-in. plank on which the concrete is laid directly. The section has a width of 11 ft. and a height of 7 ft. between the roof line and the top lines of the invert at the upper end, the invert being a flat inverted arch, with a depth of 1.87 ft. at the center at this point. A single layer of brick lining is placed in the invert, with 8-in. of concrete between the bottom of the brick and the plank floor. The full width on the bottom is 15 ft., the vertical sidewalls being 2 ft. thick. The walls are reinforced above the top line of the invert with two vertical rows of horizontal ¾-in. corrugated steel bars, made by the St. Louis Expanded Metal Co. Each row is 6 in. inside the face and the bars in the rows are 12 in. on centers. The roof is 20 in. thick and is carried by 15-in. 80-lb. transverse I-beams, placed 3 ft. on centers, with their ends on heavy bearing plates in the walls, and by ⅞-in. longitudinal corrugated bars, 6 in. on centers. The ends of the bars rest on the lower flanges of the I-beams, and the latter are tied together by eight ¾-in. rods, in four pairs.

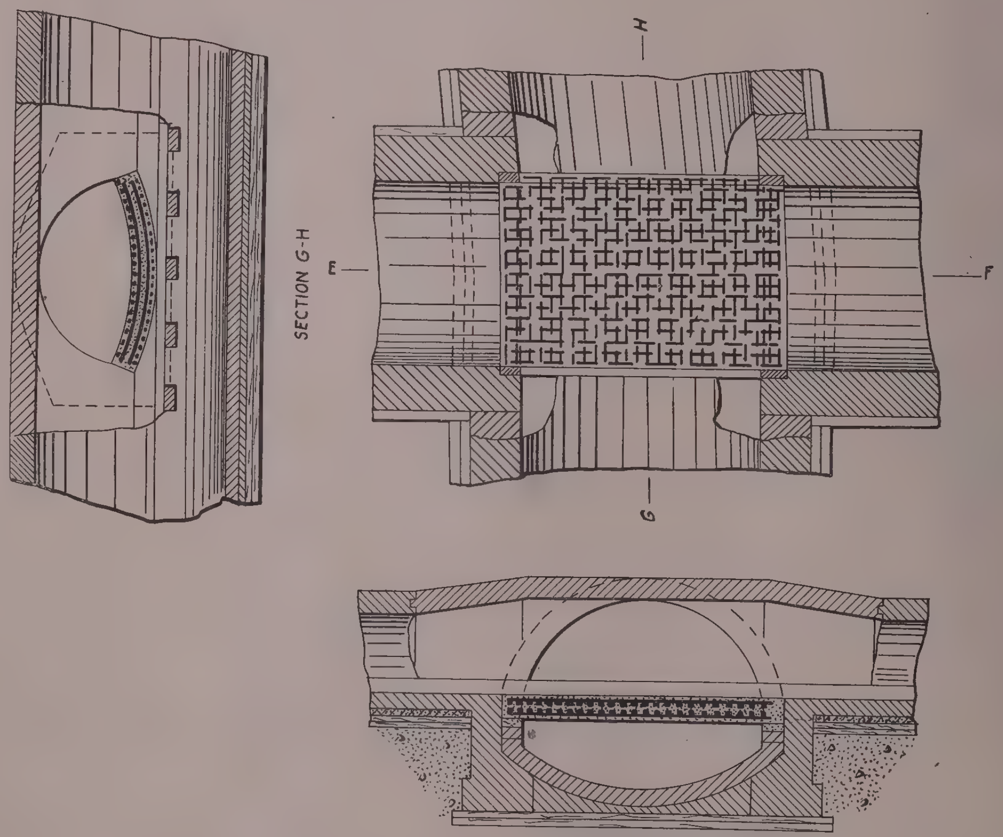
The section of the sewer gradually changes until at the dock line it is 15 ft. wide in the clear and only 3.08 ft. high above the line connecting the top lines of the invert, the depth of which is increased to 3.22 ft. at the center of the sewer. Practically the same method of reinforcing is followed for this section as was employed on the section near the beginning of the concrete work.

The storm-water overflow between the old and the new 10-ft. sewers is made about 1,200 ft. from the connection between the former and the 4.5-ft. sewer. The invert of this connection is 30 in. above the invert of the new sewer, so the sewage flow will be fully carried by the latter. From its storm-water connection to its junction with the 12-ft. sewer, a distance of nearly 1,500 ft., the more recently built 10-ft. sewer is being wholly reconstructed in order to improve its grade and to avoid deposits over its invert.

All of this sewer has a horseshoe-shaped section, built in brick, with flat-arch inverts, over which a considerable deposit of mud had accumulated. At the upper end of this reconstruction work the base and arch of the sewer will be left intact; but its height will be increased by raising the arch and building new bench walls of concrete. The grade will also be changed by laying directly on the old invert a new concrete invert lined with brick. This new invert will be divided into a deep channel along one side, almost semi-circular in cross-section, in which the normal flow will be carried, with a bench along the other side, sloping toward the channel.



Cross-Sections of Reconstructed Sewer Leading to Canal and of Rebuilt 10-ft. Sewer.



SECTION E-F

Storm-Water Connection Between 4.5-ft and Old Sewer Leading to Canal.

The headroom becomes limited as the sewer approaches the junction with the other two and in order to change the grade of the invert without decreasing the carrying capacity of the sewer, it is necessary to remove the old brick work above the springing lines of the arch and to build vertical sidewalls and a flat roof. All this reconstruction is in concrete. The sidewalls are made 2 ft. thick and are reinforced with two vertical rows of ¾-in. longitudinal rods, spaced 6 in. inside each face of the wall, and 12 in. apart vertically. The concrete roof is reinforced with 12-in. 55-lb. transverse I-beams, spaced 3 ft. apart on centers, with ⅞-in. longitudinal rods, 6-in. on centers, bearing on their lower flanges.

This flat-top reinforced-concrete reconstruction of the 10-ft. sewer is continued about 430 ft. to the junction of the latter with the other two sewers at the beginning of the 12-ft. one. The reconstruction of the 12-ft. sewer has been undertaken for about 1,250 ft. from its beginning. The span of the flat roof in this part of the work is 14 ft., and 15-in. 60-lb. I-beams have been substituted for the 12-in. beams used in the roof of the reconstructed 10-ft. sewer, where the span is 12 ft. The headroom becomes ample again from the lower end of this reconstruction work, so only slight changes are required to continue the increased grade of the invert until it meets the grade of the old invert. The top ring of brick in the old invert is removed and a layer of concrete, which gradually decreases in thickness is placed in the bottom of the sewer and the ring of brick laid over it again.

The reconstruction work was designed and is being carried on under the direction of Mr. Henry R. Asserson, chief engineer of the bureau of sewers, borough of Brooklyn of New York City. Mr. F. C. Bates, assistant engineer, was in immediate charge of the reconstruction of the old sewer discharging into the canal and the building of the storm-water connections to it. He is also supervising the change of grade in the other sewers. Mr. Geo. W. Phillips was the contractor for the former work, while the latter contract is that of H. A. Rutan & Co.

The Percival Reinforced Concrete Ties, which were laid in the Galveston yard of the Galveston, Houston & Henderson R. R. on June 28, continue in good condition, although subject to very heavy traffic. They have a triangular cross-section at the center and rounding ends.

Timber Tunneling in Quicksand.

There has recently been built in Newton, Mass., a 20 x 30-in. sewer, of which about 500 ft. was constructed in quicksand by means of timber tunnels, driven by the regular city laborers with little or no experience in such work. The bottom 2 ft. of the ground penetrated was quicksand in every case, and most of the material above was of a similar character. The ground water level was 9 to 10 ft. above the sewer grade. This was an unusual piece of construction, and from a description of it read before the Sanitary Section of the Boston Society of Civil Engineers, by Mr. Rufus K. Porter, the following notes and illustrations have been taken. The full paper and the valuable discussion on it will be found in the August "Journal" of the Association of Engineering Societies.

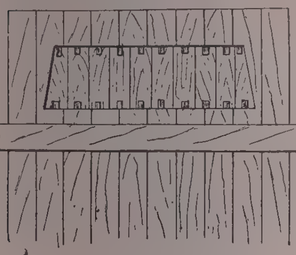


FIG. 1.

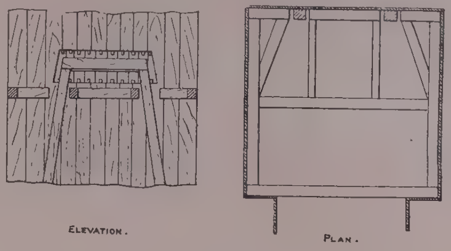


FIG. 2.

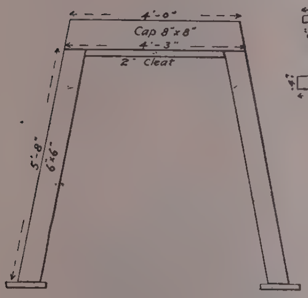


FIG. 3.

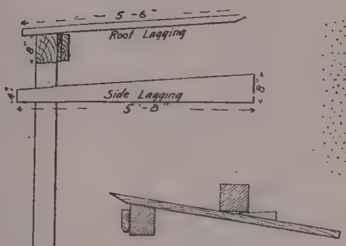


FIG. 4.

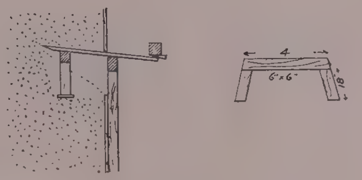


FIG. 5.

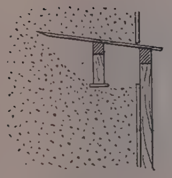


FIG. 6.

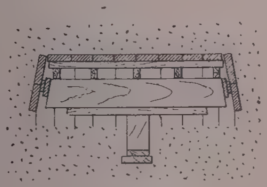


FIG. 7.

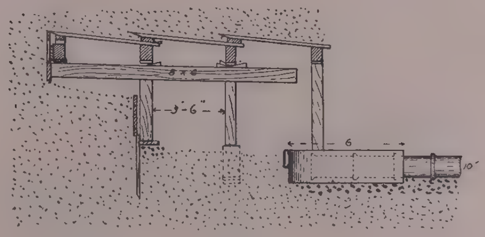


FIG. 8.

Diagrams Illustrating Method of Tunneling in Quicksand.

In the first place, it was necessary to cut through the sheeting which formed the end of the tunnel shaft. A line of holes 4 ft. 6 in. long, Fig. 1, was bored through the plank 4 ft. above grade, and 18 in. below this another line of holes was made. As each plank was pierced by the second line of holes, the piece between the two lines was chiseled out and an inch board 18 in. long was set in place and secured by wedges. Where there were braces across the shaft which interfered with the legs of the first cap, an opening was cut across them large enough for the legs to be inserted. Any weakening of these braces was taken care of by bracing of a temporary nature, the details of which differed according to the place. A method sometimes used is shown in Fig. 2.

The first frame, consisting of a cap and legs, was set up against the bulkhead. The dimensions of these timbers are given in Fig. 3. The lengths of the legs, however, were altered from time to time, as necessary, the idea being to get the foundations as low as possible. The ground was so bad that it was never possible to see the footings of the legs, and even in the shaft from which the tunnel was started the sand boiled so seriously that boxes had to be used in which to set the legs.

A 1-in. and a 2-in. piece were nailed to the front of the cap, bearing against the breast, the cap proper being 3 in. from it, so placed that should the breast kick in a little at the bottom, there would still be some play.

The roof lagging pieces were then set up, the front end resting upon the cap, and the back end passing under and wedged down from a heavy timber running across the shaft, and braced or wedged down from the rangers, Fig. 4. This wedging will be spoken of hereafter as tailing. The breast boards shown in the first sketch were then dropped a couple of inches, and the roof lagging was driven into the loose dirt behind the sheeting. After the roof lagging had been driven in far enough to stop any running of the material behind the sheeting, the breast boards were removed entirely and the sand behind them was allowed to run until it had assumed its natural slope. The two upper lagging pieces on each side were then entered, being tailed in the same manner as the roof. This side lagging was always driven along with the roof lagging. As the roof was given a pitch of about 1½ in. to the foot, it will be seen that had the side lagging been made rectangular and driven horizontally, a space would have been left between the roof and the top of the side lagging. To remedy this the first side-lagging pieces were made wider at one end than at the other, and in wet places enough of these squegee or taper side-lagging pieces were used to give the sides a decided downward inclination.

After the roof timber had been driven in about 3 ft., the sand was partially excavated and a temporary cap or horse-head was set up, Fig. 5, the dotted line showing the extent of the excavation to the point described. First the dirt under the roof was cut out and the cap was shoved up, until it rested on the dirt. Then a small trench was cut under the middle of this cap and a center prop was set in, after which the side legs were set in place and tightened up with wedges. This work had to be done very cautiously on account of the nature of the ground.

The horse-head being in place, the roof was then landed, that is, driven to the full length of the lagging. Of course, during all of these operations only enough dirt was removed to allow for the driving, for setting the horse-head, etc. Fig. 6 gives some idea of the excavation up to this time. The ground was then carefully cut away under one roof-lagging at a time, and a breast board (that is, an inch board 18 in. long) was set up perpendicularly under it. These boards were generally set on a footing board 2 in. wide and secured at the top by a wedge and thus helped the horse-head somewhat in supporting the roof. Any cracks in the lagging were stuffed with hay, which was found to be the best material for the purpose, because it allowed the water to drain through freely, while at the same time it held the sand back securely.

The cap was then brought in and set up against the breast boards under the end of the lagging, and adjusted to line and grade. (See Fig. 7.) The cap was graded with a carpenter's level from the adjoining cap, the elevations of the caps being checked every two or three days by the grade party.

On top of this cap were placed five "chocking blocks," 7 in. long, 2 in. wide and 3 in. thick. On top of these blocks was set a waling board 2 in. thick and of the same length as the cap. In driving, the side lagging followed the roof lagging, the first strip being about a foot behind the roof, the next one 18 in. and so on. The cap having been adjusted, the two top side-lagging pieces were driven up flush with the breast and a wedge was driven between the cap and the side lagging, thus securing everything firmly in place. A narrow trench was next excavated under the middle of the cap and a short center prop, resting on a foot block, set in. Between the foot block and center prop the point of a wedge was inserted and the wedge driven home, thus raising the waling board so that it bore firmly against the roof and supported it. The roof now being supported by this waling board, or rather by the cap and the waling board, this horse head could be taken out at any time that it interfered with the work.

An extra side-lagging strip was then driven on each side, and the dirt on each side of the center prop was carefully cut away, leaving an 8-in. perpendicular face. Against this face were placed two planks each 8 in. wide. The back ends of these planks butted together behind the center prop, and were secured at the sides by wedges driven between their opposite ends and the side lagging.

Two 8 x 6-in. timbers 10 ft. long, called "the bars" were then brought in and the ends placed under the cap, butting against the breast boards just set. The middle of these timbers rested on legs with a solid foundation previously prepared, and the back ends passed under, and for the first section were wedged down from, a timber placed across the shaft below a set of rangers. In subsequent sections they were wedged down from a cap already in place. Fig. 8 shows the arrangement of those bars. The sketch shows also the breast boards which were put in first, and what were called the halved breast plank, the ends being supported by cantilever bars.

The center prop was then removed, the roof being supported by the bars, and the whole width of the breast was cut down at once. A side lagging on each side was first driven and the dirt cut away to a perpendicular face from 4 to 6 in., depending on the amount of water in the ground. A plank of the same width was then put against this face and secured at each end by wedges. This work had to be done very quickly, as the material was generally too wet to hold a perpendicular face for more than a couple of minutes. The water, it might be added, was taken through the permanent 10-in. underdrain to a well at the shaft, from which it was discharged by a pulsometer.

When the breast had been worked down in this manner as low as possible, inch boards, called cribbing boards, were set upright against the breast and driven into the sand. These boards were made as long as could be driven, but seldom more than 2½ ft. long, as it was rarely possible to work the breast low enough to set up longer ones, for it was necessary to work the breast down 2½ ft. in order to set up 2½ ft. cribbing. Sometimes it was impossible to get in more than two horizontal planks because of the softness of the breast. In that case the sand at lower edge of the last plank was leveled and a row of shingle was placed against it and forced into the sand. A shingle being 16 in. long, the bottom could be held by the sand and the top tacked to the cross plank of the breast.

When the sand was taken away a plank was immediately placed against the perpendicular face. The shingles being thus held by this plank, enough sand could be cut away to put in another breast-plank, after which another row of shingles were put in and the operation repeated. Shingles were used because they were most available, but were much of that work to be done 3/16-in. iron plates, made about 16 in. long and 4 in. wide, would be found more satisfactory.

As it was unsafe to rely upon the bars for the support of the roof for any length of time, a long center prop was then inserted under the middle of the cap. It will be seen that it was necessary to put the foundation of this center prop as low as possible, to prevent undermining it when digging for the side legs; moreover, great care had to be taken in digging near the bottom of the cribbing to prevent the kicking in of the material at this point. Boxes were, therefore, constructed of inch boards, 2 to 2½ ft. long, open at top and bottom, and 8 in. wide in the clear. These boxes were set upright on the sand where the footing of the leg was to be placed, and driven down with a sledge. As the box was sunk the sand inside of it was bailed out with a tin dipper—each box being in effect a miniature caisson; when at the required depth, a foot block 8 in. square was placed in it, the center prop was placed upon it and set up under the cap. The center prop was set low enough for the insertion of two wedges, between the cap and prop, which being driven home brought the weight of the cap up on the center prop.

The bars could then be taken out, and another side-lagging piece be driven on each side. After digging the ground out as low as possible, the side cribbing, which had to be below the underdrain, was driven and boxes were set up and driven for the side legs in the same manner as has been described for the center leg. These boxes were always driven lower than the bottom of the underdrain, but it was sometimes impossible to excavate more than halfway down inside of them on account of the boiling of the sand. In such cases the legs were a little short, and when it was found possible to hammer them down, an extra foot block was inserted, and care had to be taken to prevent kicking in at the top. The boxes used were a make-shift, improvised on the spur of the moment. Sheet steel boxes, running in grooves, so one side could be driven at a time, would be more efficient, since they could be driven down farther and more easily and could be made larger so that larger foot blocks could be used.

In order not to interfere with the drainage, 6 by 6 pieces were placed on each side of the section dug, close to the sides, and across these planks were laid, so that the sand coming out of the next heading would fall on the platform thus made and not obstruct the drainage underneath. In this way any sand that was dry, was kept dry and removed from the tunnel in that state. By the time this platform was placed, the section was generally very soft, but by the time that the material was ready for removal from under the platform it was generally found to be pretty solid, in part on account of drainage and in part on account of gravel put in.

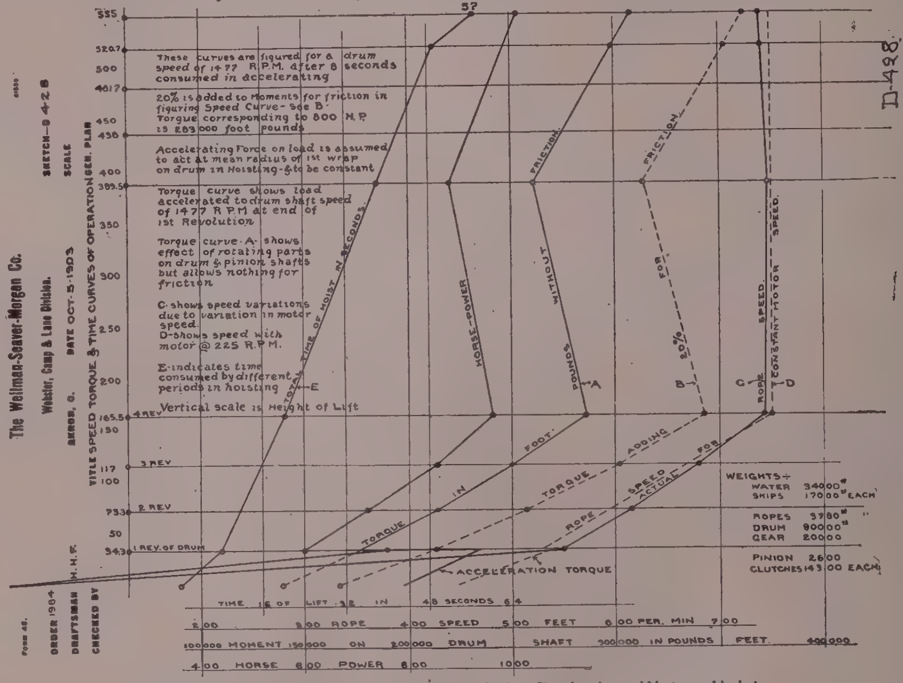
A Reinforced Concrete Highway Bridge.

A reinforced concrete bridge 240 ft. long has recently been built in Wabash, Ind., to carry a 32-ft. roadway over a creek. It has two arches of 75-ft. span in the clear and 18 ft. rise. The curve of the intrados is a parabola. The thickness at the crown is 18 in. and at the haunches 3 ft. 4 in., and the design was made in accordance with the methods of the late Charles E. Greene. The arch ring is reinforced entirely with Kahn trussed bars. In the intradoes 1¼ x 3¾-in. bars 24 in. apart on centers and 30 ft. long were used at the haunches and 1 x 3-in. bars on 24-in. centres over the whole arch. The extrados bars are 1¼ x 3¾-in., 24 in. on centers and 40 ft. long over the crown, and 1 x 3 in. over the whole ring. There are a number of ¾-in. round rods crossways in the bridge to resist temperature stresses and the like. The concrete in the ring is a 1:2:4 mixture, using broken stone. A special effort was made to have both arches as nearly continuous as possible, and for this purpose a number of inverted 1 x 3-in. Kahn bars were placed at the junction of the two rings on the center pier, which is 6 ft. wide. The spandrel walls are vertical slabs of 1:2½:5 concrete reinforced with trussed rods. The concrete for the arch rings was laid very wet and required little tamping.

Two Gas Engine Stations will be built by the Boston Elevated Railway Co. in order to test practically the operation of such plants in railway service. At Medford, a 1,500-h.-p. producer gas plant will be built by R. D. Wood & Co., and three 500-h.-p. Koerting gas engines, direct-connected to Crocker-Wheeler generators, will be installed. At West Somerville, the Power & Mining Machinery Co. will install two Loomis-Pettibone generators, with accessory apparatus, and put in two American-Crossley gas engines rated at 600-h.-p. each, direct-connected to Crocker-Wheeler generators.

A Novel Water Hoist.

The question of unwatering a mine always is a serious problem to the mine management, especially so when the water is highly impregnated with acids. When the amount becomes excessive the means to be employed for disposing of it taxes the ingenuity of all concerned to the utmost. In the anthracite regions there are mines in which for every ton of coal raised as much as 14 tons of water must be pumped, and this must be done at a minimum of expense. Nowhere, probably, have a greater variety of pumps and lifting devices been tried, and the most satisfactory type, up to date, for handling large quantities of water at comparatively low heads is stated to be large bailers operated by steam engines. These, however, lack the mechanical regularity inherent in a pump, as they are necessarily operated by men; and it remained for the Delaware, Lackawanna & Western R. R. Co. and its electrical engineer, Mr. H. M. Warren, finally to develop a water-hoisting equipment which would preserve all the valuable points of the steam hoist and at the same time operate automatically. The carrying out of the mechanical details of the hoist and its automatic devices were confided to The Wellman-Seaver-Morgan Co., of Cleveland, O., and the successful operation of the plant reflects much credit on the latter, as they guaranteed the machinery to accomplish the desired results. Most of the electrical controlling devices were furnished by the Electric Controller & Supply Co., Cleveland, O.



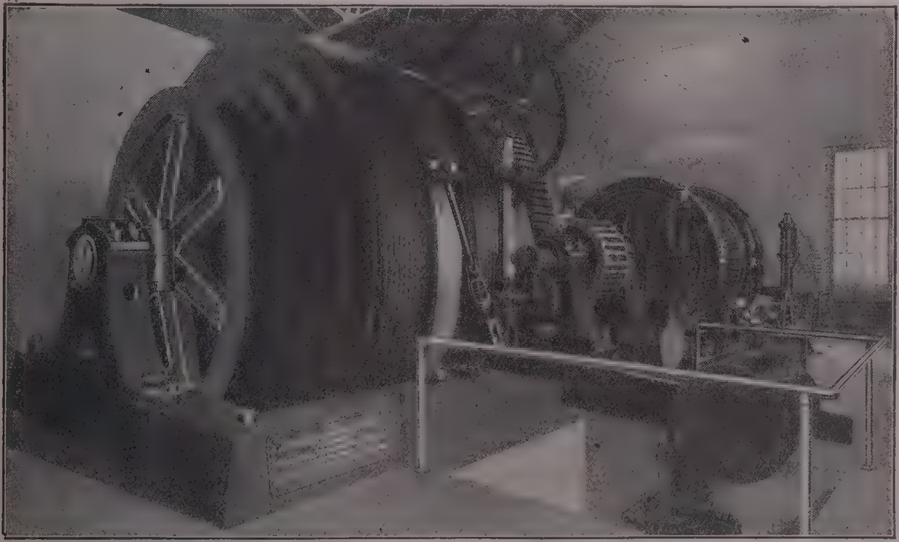
Speed and Movement Curves Used in Designing Water Hoist.

In the original specifications the D., L. & W. R. R. Co. called for the hoist to be operated by an alternating current motor of 800 h.-p. and the question of starting, stopping and reversing so large a motor had, at the outset, to be met. The duty to be performed by the hoist called for the raising of 4,000 gal. of water per minute to a height of 550 ft. The 4,000 gal. of water at 8.27 lb. was equal to 33,180 lb. to be raised, and 500 ft. of 2-in. rope at 6.3 lb. amounted to 3,465 lb. more, or a total of 36,645 lb. to be raised 550 ft. per minute. 36,645 × 550 ÷ 33,000 = 610 net horse-power. The weight of the bucket was one-half the weight of the water, so that weight on rope was 53,235 lb. or nearly 27 tons, requiring 2-in. steel rope. The various preliminary speed and movement diagrams were laid out as shown in the accompanying diagram.

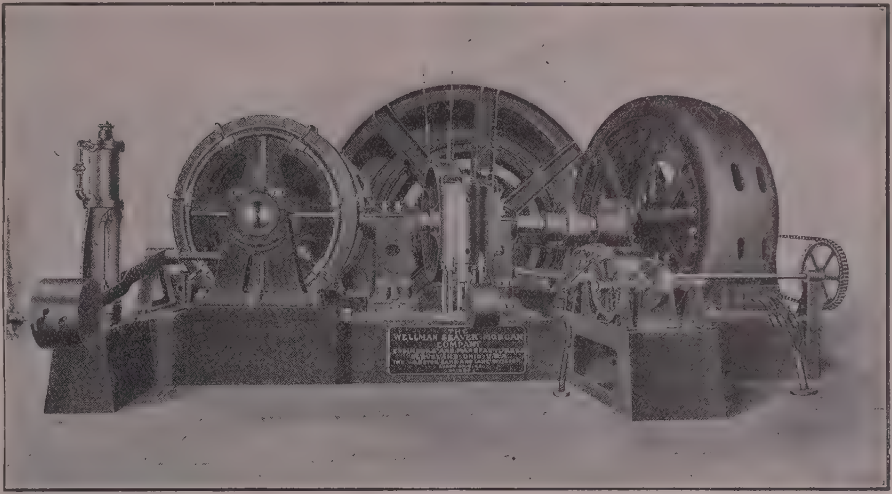
It was decided in carrying out the design that it would be impracticable to design the hoist except with a motor running continuously in one direction, as it is a well-known fact that the amount of current required to accelerate a large motor of this type is enormous and greatly interferes with the proper running of the power plant. The D., L. & W. R. R. Co. desired to use an alternating current motor directly at the hoist, and as it was to run continuously in one direction, this necessitated the use of friction clutches for accelerating and reversing the load. As The Wellman-Seaver-Morgan Co. had several smaller plants already in operation, using alternating current motors on hoists which are operated similarly to the present hoist, and as they are running successfully, and the repairs and renewals for clutches had not exceeded that required for the other hoisting engines, it was decided to use this method.

Two of the accompanying illustrations show front and side views of the hoists. As will be noticed, the general arrangement consists of a motor driving a pair of bevel wheels through a single bevel pinion. The bevel wheels run loose on a shaft and are fitted with the well-known Webster, Camp & Lane friction clutches. The operating mechanisms for the clutches are so designed that only one clutch can be thrown in at a time, but both clutches can be out at the same time. Throwing in one clutch runs the drum in one direction; throwing in the other clutch reverses the motion of the drum.

To the shaft on which the bevel wheels run there is keyed a pinion meshing with main gear on the drum shaft. The drums are of the cylindrical-conical type, 10 ft. at the small diameter and 16 ft. at the large diameter. At a hoisting speed of 550 ft. per minute the drum makes about 15 r.p.m. There is one main brake located between the drums. All of the clutches and brakes are operated by auxiliary air cylinders fitted with oil cushion cylinders, the compressed air being furnished by a motor-driven air compressor with the necessary tanks located near the hoist.


Side View of Water Hoist Driven by an Alternating Current Motor.

The hoist is controlled by a mechanical device shown in the front view. This consists mainly of a drum rotated by means of a friction drive from the motor through a sprocket chain. The drum shaft transmits its motion to a secondary shaft fitted with a variable speed device which in turn operates a secondary stop. The main hoisting drum shaft operates a traveling nut so located with respect to the controller drum that at either end of its travel releases a stop and allows the controller drum to make a quarter turn; this movement, through suitable electrical connections, operates the solenoids on the clutch valve, releasing the clutch and the solenoid on the brake valve setting the brake, the further movement of the controlling drum being arrested by the secondary stop. This stop is released by the variable speed shaft and its connections, which has been given a predetermined time movement corresponding to the interval for emptying the bucket. The further movement of the controlling drum releases the brake and throws in the reversing clutch, thus starting the hoist in the opposite direction, and also starting the traveling nut on the controlling mechanism in the opposite direction. At the end of the hoist the cycle of controlling movements is repeated, and so on, making the hoisting operation continuous and automatic.


Front View of Water Hoist Driven by an Alternating Current Motor.

Every attention has been given to the safe operation of the hoist. The main brake is of the gravity type and to be released the current must be on the solenoid operating the valve so that air can be admitted to the underside of the brake piston. If for any reason either the supply of current or of air pressure is interrupted, the valve drops, and the weights on brake lever set the brake. The clutches are designed so that they are thrown out by weights. As is the case with the brake, either clutch can only be thrown in when the current is on the solenoid, and the air pressure admitted under the piston, and if either current or pressure fail, the clutch is off. The motor shaft is fitted with an emergency brake operated by a weight controlled by a solenoid; any interruption in the flow of current to the motor sets the brake and stops the motor. Any interruption of the flow of the current stops the machine, throws out the clutches and puts on the brake. A safety cut-out is provided for in the head frame so that in case a bucket is carried beyond the proper height the current is cut off.

The head-frame, shown in one of the views, is 93 ft. from the base to the center of the sheave at the top. It is built of structural steel, roughly in the shape of an A. From it are suspended two buckets 6 ft. in diameter and 19 ft. 6 in. deep. The capacity of each bucket is 17 tons of water. In the bottom of the bucket are located two lift-gates with an area practically equal to the cross-section of the bucket. These gates are lifted automatically when the bucket reaches the top, and the water is discharged through the bottom into a spout fitted below the bucket, and which deflects it to either side of the shaft. Each bucket makes a complete round-trip in one minute and fifty seconds, the total lift being 555 ft.

A New Coalfield in Colorado.

A new coalfield that is expected to prove of considerable importance has been studied by members of the U. S. Geological Survey last summer. In a remote geologic age thick sheets of lava were forced into the coal formations of Routt county, Colo., and beds of coal within 50 to 75 ft. of such sheets were changed to anthracite or semi-anthracite. The cretaceous coals examined were distributed through a vertical thickness of 1,000 to 2,000 ft. of strata, chiefly sandstone and shales.

It was quite impossible to determine the extent to which the lava beds had influenced these coal seams, because the surface is densely wooded and outcrops of rock and coal are very few. Anthracite coal is known to occur in patches, at least, on an area of at least 50 square miles, and there are probably over 500 square miles affording more than 10 ft. o fworkable coal. Up to the present time only a few tunnels have been driven more than 100 ft., for coal for domestic use only. It is expected, however, that with the coming of the Denver & Northwestern R. R., the importance of this field will receive full recognition.

A STRANGE DECISION CONCERNING TENDERS was recently made by the Nebraska Supreme Court in Gutschow v. Washington County, 104 N. W. Rep. 602. The official syllabus reads as follows: "A bid which proposes 'to construct, excavate and complete by working sections' at a fixed price per cubic yard of earth [excavation] responds to a notice that required bids to be made 'by each working section,' since the proposal means at the same price per yard for each section or for the whole work."

Motor Drives at the Pittsburgh and Lake Erie R. R. Shops.

The arguments for and against the use of motor rather than belt drives in industrial establishments are often based on the relative amounts of power used by the two systems. In some works it may be important, but in others it is a very small matter. For example, in the new shops of the Pittsburgh & Lake Erie R. R., at McKees Rocks, the total cost of power in 1904 was slightly over one-half of one per cent. of the cost of labor and material. Consequently the advantages of the motor drive in those shops must be sought in other directions, probably in the greater facility with which the work is handled by the tools. Some idea of this advantage is afforded by statements by Mr. G. M. Campbell, electrical engineer of the company, in a paper recently read before the Engineers' Society of Western Pennsylvania.

The shops are compactly situated and consequently direct current could be used to advantage; the voltage in use is 250. For machine work, the multi-voltage system of drive is used and with excellent results. The voltages vary by steps of 40 from 40 to 240, with intermediate and additional steps obtained by means of field resistance. The controllers in use have 21 steps in forward motion, giving approximately 10 per cent. increments. Individual motor drive was carried to a much greater extent than in any shop previously put up, but experience has not shown that any mistake was made in so doing. In the machine shop only one small group of tools is driven from shafting. All the others have individual motors. The tools in the group above referred to are such tools as drill grinders, polishers, bolt threading machines, etc. In the wood working shops, however, group driving is the rule; individual motors are used only on the larger machines; in general in machines of this class no change in speed is required and therefore group driving is entirely satisfactory.

One excellent feature of the electric installation is the entire absence of exposed wiring, and yet every foot of the floor of the 172 x 530-ft. machine and erecting shop is accessible. This is accomplished by running a tunnel 3 ft. 6 in. by 4 ft. the full length of the shop, and from it 4 x 12-in. branch ducts from side wall to side wall every 5 ft. 6 in. These latter were made part of the floor and were put in practically without expense. All the wiring in these ducts was put in after the floor was put down, loricated conduit being used.

In order to protect the machine, the motor is controlled through a fused switch and also a circuit breaker. Up to date there have been only three cases where the machine gave way, though all the machines have had severe work. The weak parts, chiefly gears, were replaced in these instances by heavier material, and no further trouble is expected. In obtaining speed variation, in a large number of machines it is impossible to obtain it entirely by the motor. Speed ranges of 50, 75 or 100 to 1 are not at all infrequent, such, for example, as changes given by the old triple or quadruple geared lathes. This is, in an electrically driven tool, taken care of by obtaining, say, a 3 to 1 variation in the motor and the necessary number of change gears, each increasing the speed in proportion of, say, 3½ to 1. A very common method of obtaining these changes is to use sliding or rocking gears. This Mr. Campbell considers bad design; nothing but clutches should be used, he says, for otherwise it is impossible to change from one gear drive to another except when the machine is idle, and then on the heavier machines only with difficulty, whereas with clutches the change can be made without stopping the machine. In the P. & L. E. R. R. equipment this point was absolutely insisted on despite the severe opposition of every tool maker. Magnetic clutches for the reciprocating tools were not used, as it was considered that the improvement in results would not be sufficient to warrant the expense, and also the clutches at that time were in a state of development. Better results may now be obtained and probably at lower cost.

The complete list of all motors installed numbers 83. This list of motors shows sizes as follows:

No.	Rating.	T'l H.P.	No.	Rating.	T'l H.P.
1	2	2	1	13	13
6	3	18	13	15	195
6	4	24	3	20	60
11	5	55	7	25	175
3	6	18	3	35	105
16	7½	120	1	45	45
1	9	9	1	60	60
10	10	100			
			83		1000

It should be noted that the rating is for full speed and voltage, not the actual horse-power obtainable at all times and not the horse-power required by the machines. The horse-power rating for the variable speed machines would be only 40 to 50 per cent. of the motor rating. The other motors around the plant would add about 450 h.-p. and the cranes about 250 h.-p., bringing the total motor rating up to about 1,700 h.-p. Of the 83 motors, 75 are used for individual drive and 8 for group driving, 5 of these 8 being in wood-working shops; 27 are constant speed and 56 variable speed motors. The total cost of these 83 motors was $20,275, or an average cost of $244.50, exclusive of mounting. The same motors could now probably be bought from 15 to 25 per cent. cheaper. The average horse-power of these 83 motors is 12.05.

During the year 1904, the average horse-power taken by all machine tool motors was about 200 during working hours, but all the tools listed above were not in operation. The average power consumption at present is about 300 h.-p., or about 30 per cent. of the rating of the motors. During the year 1904, the average power consumption of the machine tools was 17.3 per cent. of the output of power house; it was 38.71 per cent. of the total electric power; lighting was 24.9, heating motors 23.78 per cent. The electric power consumption of the machine tools including cranes and blast fan was subdivided as follows: Variable speed tools, 39.71 per cent.; constant speed tools, 26.80 per cent.; blast fans, 28.44 per cent.; cranes, 5.05 per cent.

Head Frame of a Water Hoist at a Lackawanna Colliery.

The total cost of power for the machine tools, including the cranes, was $2,662.66, this does not include the maintenance of motors.

In addition to the shops being well equipped with motor-driven tools, there are at present in service seven cranes from 120 ton to 7½ ton capacity. Three more will be added shortly.

The capacity of the power house for electric work is 600 kw. full load rating, or 750 kw., with 25 per cent. overload. There is space for one additional generator of 150 kw. capacity.

A few items are given in the accompanying table concerning speeds of cutting. These are not given as maximum and are not special tests, but are every day practice, as previously stated.

SAMPLE CUTTING SPEEDS.

No.	Machine.	Wt. removed lbs. per min.	Speed ft. per min.	Material
10	Lathe,	2.63	106	Cast iron.
10	Lathe,	2.33	44	Steel.
16½	Lathe,	1.69	170	Steel.
13	Lathe,	3.43	43	Steel.
20	Lathe,	4.2	54	Wrght. iron.
14	Wheel lathe,	6.3	13.2	Steel.
23	Wheel lathe,	5.3	15.5	Steel.
51	Planer,	3.2	30	Cast steel.
52	Planer,	18.3	29	Cast iron.
62	Shaper,	2.03	120	Brass.
39	Drill, ¼-in.,	0.52	74.5	Wrght. iron.
147	Drill, ¼-in.,	0.88	53.9	Wrght. iron.
33	Boring Mill,	1.1	59.5	Steel.

Railroad shops are in general repair shops, so the weight of metal removed is not at all remarkable, compared to many tests which have been reported.

The new shops are considered an excellent investment despite the heavy first cost, and it is estimated that they will have paid for themselves, including first cost and interest, in ten years or less.

Tunnel Contractors will be interested in a decision recently made by the California Court of Appeals in McRea v. Erickson. According to the syllabus in 82 Pac. Rep. 209, the court ruled as follows: "The excavation of a tunnel and its completion to a temporary grade, over which is laid a temporary track, which is but a few inches from the level of the regular grade, the tunnel being completed, except for timbering and completing the excavation to the regular grade, is a substantial completion of the portion of the tunnel so excavated, within the rule making the completed portion of the tunnel an appliance and means to prosecute the work, furnished by the master, which he is bound to use ordinary care to render a safe place in which to work.

The Kingsland Shops of the Lackawanna R. R.

The Kingsland, N. J., coach and locomotive shops of the Delaware, Lackawanna & Western R. R. will cover an area of 8.5 acres and represent an expenditure of $1,000,000 when completed and equipped. They are about 6 miles from the eastern terminus of the Lackawanna at Hoboken, N. J., and on the edge of the swamp meadow land which borders along the Hackensack River. The passenger equipment used in handling the railroad company's heavy business between the suburban towns in New Jersey and the terminal of the New York City ferries at Hoboken, as well as that employed in carrying the through traffic of the road, will be kept in repair in these shops. Only those engines in service on the Morris & Essex division, however, will be repaired in the locomotive shops. The yards where the eastbound freight business is sorted and the westbound trains made up is at Secaucus, in the Hackensack meadows just west of the double-track tunnel through Bergen Hill on the west side of Hoboken. The most feasible location for the shops, from several standpoints would have been near these yards. There was no practicable site in that vicinity, however, on which to erect the structures required, and there was also a lack of suitable grounds for the homes of the shop employes. A number of old shop buildings were located at Kingsland, which is 3 miles from the freight yards, and the new shops are being erected partially on the site of the existing ones, some of which are being torn down.

View of the New Kingsland Shops of the Lackawanna Railroad.

Interior View in the Paint Shop End of the Building.

The scope and arrangement of the shops, accompanied by a plan showing the relative location of the various buildings, were described in outline in The Engineering Record, March 25, 1905. The largest building is a paint and coach shop, 170x660 ft., with a 50x268-ft. ell at one end. On one side of this shop and parallel to it will be erected a locomotive shop, 126x608 ft. in plan. A 70x752-ft. electrically-operated transfer table occupies the space between the two buildings, and will serve both of them. The remainder of the buildings are on the opposite side of the paint and coach shop, being separated from it by an open passage-way 50 to 75 ft. wide. They include a 40x266-ft. paint and oil storage building, a 70x300-ft. paint and coach shop annex, a 60x272-ft. finished-lumber shed, a 70x264-ft. mill building, a 62x181.5-ft. power house and a number of auxiliary buildings. The old shops are beyond these buildings and will be removed.

The site is at a point where a rocky hill rises rather abruptly from the meadow land. At one side it included a small lake, which has been partially reclaimed, while on the opposite side, covering the entire site of the locomotive shop and a portion of the site of the transfer table was a rock ledge rising in some places more than 40 ft. above the floor level of the shops. This ledge has nearly all been removed, 250,000 cu. yd. of rock excavation being required to bring that part of it within the site to grade. Although this amount of excavation may appear somewhat excessive it was more than justified by the conditions. In the first place providing the necessary pile foundations in any of the other feasible sites would have involved at least as great an expenditure, with an uncertain foundation. Beside, a part of this site where some of the auxiliary buildings and the yards of the shops are to be located had to be reclaimed: the material for this work would have to have been borrowed from some other point, perhaps not so convenient, if the excavation for the locomotive shop had not been made. The chief advantage in making the excavation, however, is that the shop buildings may all be properly located wtih reference to each other, and at the same time erected on a practically solid rock foundation.

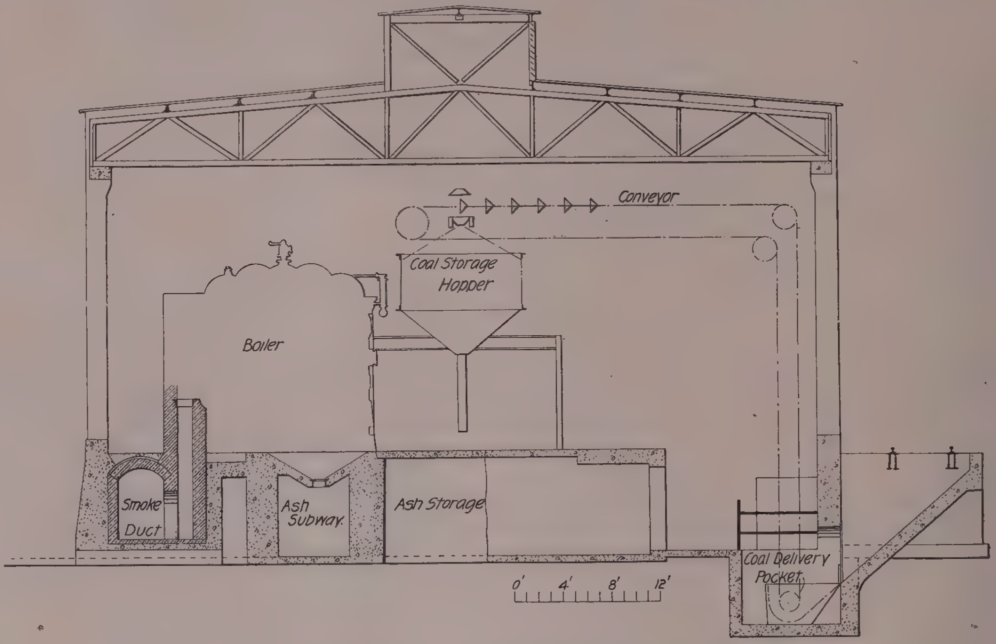
A 2½-yd. Marion steam shovel is employed in making the excavation. The spoil is removed in trains of 15-yd. King-Lawson dump cars, which are operated by compressed air from the locomotive hauling them. The rock which has to be removed is largely an exceedingly dense red shale in which considerable difficulty was experienced in making the blast holes with steam-driven rock drills. The material would rapidly form a stiff mass in the bottom of the hole, requiring the drills to be removed at almost every foot of depth and the holes cleaned. As many of the holes were 50 ft. deep this work involved unwarranted expense and delay. A Cyclone well drilling outfit was finally installed and appears to be especially adapted to the work, as the drilling and blasting have easily kept pace with the steam-shovel work since the well drill was put in operation, with 5 less men than were required in handling the rock drills.

The shop buildings are designed to be as nearly fireproof as it is possible to build them. They have brick sidewalls on concrete footings and concrete-slab roofs on steel-truss frames, the only wood employed in their construction being in some of the window frames and sashes. Sheet-steel doors are provided in all cases, and in buildings particularly exposed to fire hazards, automatic fire doors are installed. The more inflammable materials, such as paints, oils and lumber, are stored in separate buildings. The requirements of the National Board of Fire Underwriters have been followed in the design and construction of the entire plant, and the buildings are equipped throughout with automatic sprinklers.

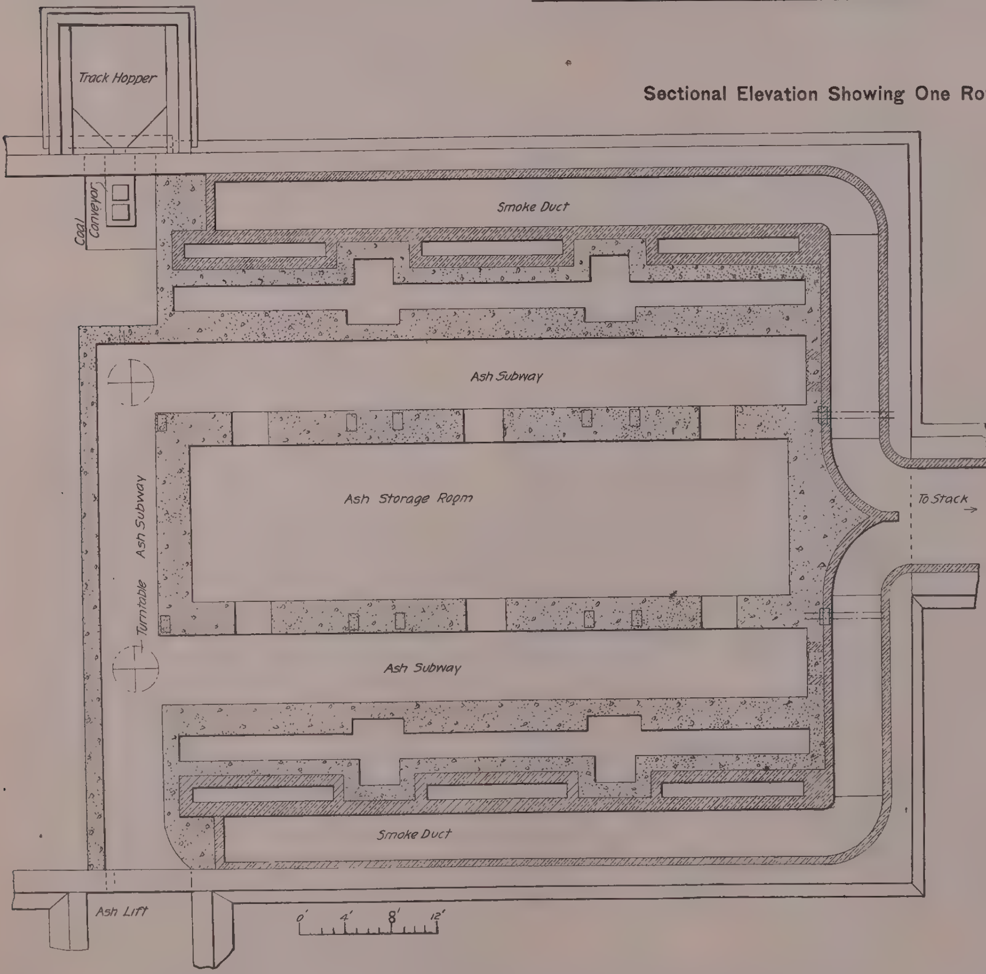
A complete water distribution system, extending to all parts of the plant, has also been installed for fire protection. Three deep wells will furnish the water, which will be raised to an elevated steel tank, 400 ft. from the nearest building of the shops, by pumps in an isolated station building and distributed by gravity through the mains. This tank has a capacity of 100,000 gal. and its flow line is 140 ft. above the floor level of the shops. The Chicago Bridge & Iron Co. has the contract for its erection. A large concrete-lined reservoir, which is supplied by a small stream flowing along one side of the shops, will furnish condenser water for the power-house equipment and may be drawn on in an emergency for fire protection. Fire pumps will also be installed in the pumping station, and when necessary the mains can be put under direct pressure from them.

A complete sewerage system, designed to carry the combined sewage and storm-water flow, has been provided. This system includes more than 1¼ miles of mains, varying from 8 to 27 in. in diameter, and will have its outfall in the Hackensack River below the shops. The shops are provided with lavatories at three separate places, the plumbing fixtures being connected with the sewerage system. The mains are proportioned to carry the complete run-off of 2 in. of rainfall an hour over the area covered by the shops, in addition to the regular sewage flow.

The erection of all of the buildings, with the exception of the locomotive shops, is practically completed and some of their equipment is already being put in place. The locomotive shops will not be put under construction until next spring. The paint and coach shop building was erected first. It is divided by three transverse brick firewalls into four separate parts. The wide portion at the end with the ell contains two parts, each 110x134 ft., which are used for paint shops. The other two parts embrace the remainder of the building, and will each contain a coach shop, with a truck overhauling shop at the end of the building. The paint shops are each served by 6 tracks, the coach shops 7 tracks and the truck shop 2 tracks, all leading in from the transfer table. A track at each end of the transfer table extends the length of the shops and connects with the main line tracks of the railroad. One track in each of the coach shops extends through the building to the finishing and trimming buildings on the opposite side of paint and coach shop from the transfer table.



Sectional Elevation Showing One Row of Boilers in Power Station Building.



Plan Below the Floor of the Boiler Room of the Power Station Building.

The transverse roof trusses of the coach shops are divided in two 85-ft. spans, each supported at one end by the walls of the building, and at the other by a column carried up from the floor. The trusses of the paint shop end of the building have a 50-ft. and two 85-ft. spans, each truss being carried at the common end of the 85-ft. spans by a column in line with those in the coach shop. The end of the 85-ft. span joining the 50-ft. span is carried by a column, the row of these columns being in line with the sidewall of the main part of the building. The steel-work for the building was thus reduced to a standard and practically all obstruction to the floor removed.

The openings through which the tracks leading in from the transfer table enter the building are each provided with a cross folding horizontal door. These doors rise on vertical guides on the side of the opening and are hinged about 15 ft. from the floor so they fold as they are being raised. The rails in the tracks inside the shop are all laid on cross ties of inverted rails. The ties and rails are imbedded in concrete which is carried up flush with the tops of the rails, with a flangeway on each side of the latter. The floors in the coach shops will be concrete finished with cement mortar. The paint shop floors have been laid with vitrified brick with asphalt joints, in order to reduce the dust as much as possible.

Permanent scaffolds will be placed on both sides of and parallel with each track in the paint shop. These scaffolds each have a 14-in. plank, 22 ft. long, which is carried by two columns built up of structural-steel shapes and carried on concrete bases in the floor. The two columns are on 16-ft. centers, making those at the adjoining ends of adjacent scaffolds 6 ft. apart. Each scaffold plank is carried directly by a steel bracket, which slides on the column to which it is attached and is held in place vertically by a spring trigger that fits in holes placed at intervals in the columns. The latter are 6 ft. 2 in. from the center line of the tracks and the brackets and planks are on the track side of them so the painters may work at convenient distance from the coaches, the scaffold planks being set at any desired height.

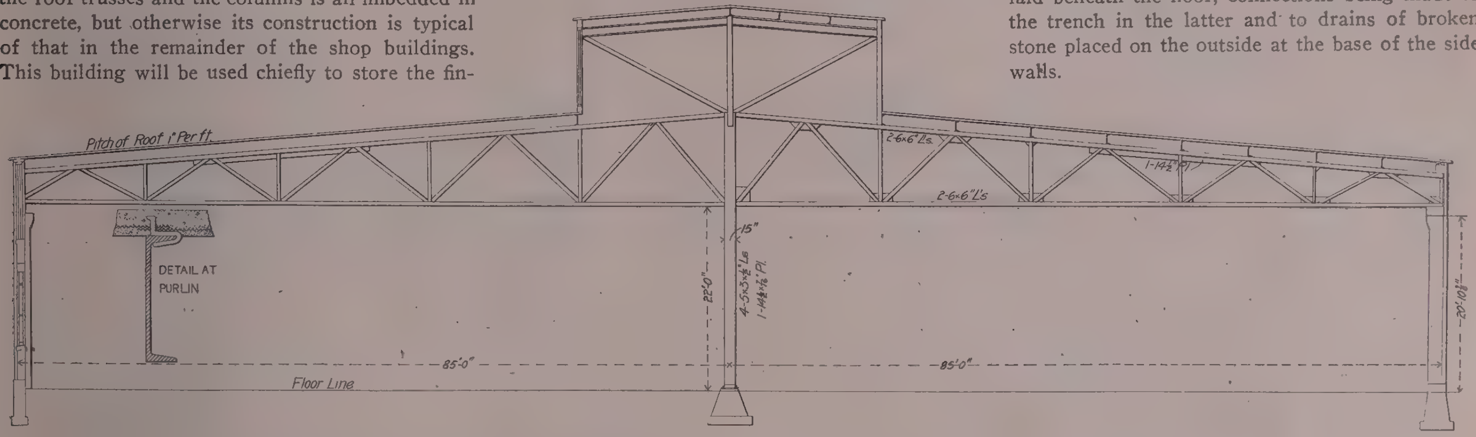
The truck shop at the end of this building will be served by a 15-ton crane made by the Niles-Bement-Pond Co. This crane has a span of 44 ft. and travels the width of the building. It is operated electrically, and is equipped with General Electric motors, which are controlled from the floor, no cage being provided. The crane runways are carried by two transverse rows of columns, one of which is in the end wall of the building.

The floor of the transfer table has a heavy concrete base, which was given a sidewalk finish on top with cement mortar. The transfer table runs on 4 longitudinal rails, clamped to inverted rails imbedded in the concrete base, thus avoiding all wood construction. The 60-in. riveted-steel water supply main of the East Jersey Water Co. extends diagonally across the transfer table and one end of the paint and coach shop. The clearance between the top of it and the concrete floor of the transfer table is from 0.1 to 1.6 ft., so special construction had to be undertaken to insure the safety of the main. The soil was first excavated around it, then it was given an extra heavy coating of asphalt pipe dip and imbedded in concrete. The rails of the transfer table are also carried across it on heavy, shallow box-girders, built up of structural-steel shapes. The ends of the girders rest on the concrete on each side of the pipe so as to relieve the latter entirely of any load.

The paint and oil storage building is on the opposite side of the paint and coach shops from the transfer table and is connected with the paint shops by a covered passageway. It is divided by firewalls into an office for the general foreman of the shops and his staff, a paint-stock room, a coach-cushion cleaning and dyeing room, a buffing and plating room and an embossing and plating room. Its construction is practically the same as that of the paint and coach shop, except that its roof trusses have a single span.

The paint and coach shop annex is placed next to the paint and oil storage building, with its end parallel to the side of the coach shop. The interior varnishing, cabinet work and upholstering work for the passenger coaches will be taken care of in it, three trimming tracks being placed along one side to facilitate the finishing work. This building also has brick sidewalls and a reinforced-concrete slab roof, with firewalls dividing its interior into various rooms.

The finished lumber building contains one large room, with a track on each side of the building. The cars on these tracks are covered by overhanging extensions to the roof and are connected with the interior of the building by a number of openings in the sidewalls. A track also enters the building at one end and extends its full length at the center. The openings in the sides and ends of the buildings are all controlled by automatic fire doors, which are operated regularly in two sets, the doors on one end and those in one side making up a set. The steel work of the roof trusses and the columns is all imbedded in concrete, but otherwise its construction is typical of that in the remainder of the shop buildings. This building will be used chiefly to store the finished work from the mill building, the latter being parallel to it, and separated from it only by the unloading track along the side. All the wood-working machinery will be placed in the mill building, which contains one large room, with brick side-walls and the typical roof construction.



Cross-Sectional Elevation of Paint Shop of Delaware, Lackawanna & Western R. R. at Kingsland, N. J.

The carpentry shop of the Morris & Essex division, which is now located in Hoboken, will be moved to Kingsland and placed in a 50 x 130-ft. brick building, similar to the other shop buildings and toward one end of their general site. A two-story frame lumber storage shed for this shop is being erected 400 ft. from the other shop buildings.

The larger machines throughout the shops will be operated in groups by electric motors, which vary from 5 to 75 h.p. in capacity and have been arranged to avoid line shafting in any of the shops. The portable tools, such as riveters and drills, will be driven by compressed air. Electric current for power and for lighting all the shop buildings will be generated in the central power house building, which is next to the mill building and in line with the end of the coach and paint shops. The air required to drive the small tools will also be compressed in this plant. The buildings are all heated by a return hot-water system, installed by Evans Admirall & Co. of New York. The water is regularly heated by exhaust steam from the various engines in the power house, but an auxiliary live-steam supply is available.

The power house is divided into a 62x80-ft. boiler room at one end, with a 62x101.5-ft. engine room occupying the remainder of the building. The walls of the building are on concrete footings built on a solid rock foundation. The boilers and machinery in it are also on concrete footings built on rock. The boiler room contains six 240-h. p. water-tube boilers made by the Stirling Co. These boilers are placed in two rows, one row of three on each side of the longitudinal center line of the building. They are served by a circular brick stack built by the Alphons Custodis Chimney Construction Co. The stack is 150 ft. high, 14 ft. in diameter at the bottom and 10.5 ft. in diameter at the top, and is built on a footing separate from those of the building.

A concrete smoke duct, 4 ft. wide and 5 ft. high to the springing line of the arch of its fire-brick lining, is placed beneath the floor between the back end of each row of boilers and the side wall of the building. The two ducts join at the end of the building and are connected with the stack by a larger concrete duct, also lined with fire-brick. The breeching of each boiler furnace connects wtih the branch duct in the rear of it. A 2-in. air space was left between the two rings of fire-brick in the arch of the lining of these ducts and the concrete in the arch of the floor over it. The brick-work of the bottom, side-walls and arch of the lining was first built and the concrete carried up to the haunches of the floor arch. Folding wedges, with their faces parallel, were then placed on the extrados of the fire-brick arch and sheet-iron forms, in 4 to 6-ft. lengths, were placed over them. Sections of the arch for the two branch ducts were laid alternately. The concrete in a section of one branch would set sufficiently while the concrete in a section of the other branch was being laid so the forms for its arch could be safely removed by striking the wedges.

Coal for the furnaces will be delivered to a concrete-lined hopper under a track along one side of the power house. A bucket elevator will raise it from this hopper to a flight conveyor which will deliver it to elevated storage bins extending lengthwise of the boiler room above the space between the two rows of boilers. The boiler furnaces will be hand-fired. Coal will be delivered from the overhead bins to a concrete firing floor between the rows of boilers by a chute leading to each pair of firing doors. All the shavings and waste from the wood-working machines throughout the shops will also be burned in the boiler furnaces. Each machine will be connected by a galvanized sheet-iron duct to a central exhauster which will discharge through a main duct leading to the storage bins in the boiler room. Several suction floor-sweeps are also provided. The system will be installed by the Allington & Curtis Co., and is arranged so the material delivered to the power house may be stored, fed directly into the fire or mixed wtih the coal in the storage bins.

The concrete floor of the engine room is carried by transverse I-beams which rest at each end on a nest of rollers in an inset in the footing of the side-wall. It is also separate from the settings of the machinery so that the vibration on it will be reduced to a minimum. The electric equipment consists of an engine-type, 300-kw. 60-cycle, 440-volt. electric generator and a 200-kw. generator of the same type, both made by the General Electric Co. A 30-kw. Crocker-Wheeler generator is also installed for an exciter, and provision is made for the installation of a second 300-kw. generator. A 32x20x30¼-in. and 18¾x24-in. Ingersoll-Sergeant air compressor, with a capacity of 2,000 ft. a minute will furnish compressed air for power and other purposes. The engines will all be run condensing, Worthington surface condensers being placed in a pit excavated in the solid rock on which the power house stands.

The electric mains, hot-water heating pipes and air-supply pipes will be carried to the various shop buildings from the power house in a concrete-lined subway, 5x6 ft. in cross-section. The electric mains will be laid in vitrified clay conduits placed on a shelf built in the side of the subway. The supply and return pipes of the hot-water heating system are suspended from the roof. The air-supply pipes are laid in a trench in the floor. The subway is drained by a sewer laid beneath the floor, connections being made to the trench in the latter and to drains of broken stone placed on the outside at the base of the side walls.

The plans for the shops were made under the direction of Mr. L. Bush, chief engineer of the Delaware, Lackawanna & Western R. R., by Mr. Frank Nies, architect of the railroad company. The construction work is being carried on under the direction of Mr. E. I. Cantine, engineer of the Morris & Essex division. Mr. J. E. Snell, superintendent of buildings and docks, has charge of the carpentry and mill work of the shops. Mr. F. L. Wheaton, assistant engineer, is in immediate charge of the construction. Mr. R. F. Kilpatrick, superintendent of motive power and equipment, has charge of the equipment for the buildings, and will be in charge of the shops when they are completed.

A CONCRETE ARCH BRIDGE of 125 ft. clear span and 39 ft. rise above the springing has been commenced at Washington to carry 16th St. over Piney Creek. Like the Charley Creek bridge recently completed at Wabash, the arch rib is parabolic, but, unlike that bridge, it will be of concrete without reinforcement, 5 ft. thick at the crown, and figured for a maximum working stress of 500 lb. Congress appropriated but $50,000 for the structure, so it will be but 25 ft. wide. When more money is available another bridge will be constructed alongside and the intervening space spanned by the floor system, in the manner adopted for the Luxemburg bridge. The main arch rib will carry spandrel walls and a central row of columns, all of reinforced concrete. The bridge was designed by Mr. W. J. Douglas, engineer of bridges of the District of Columbia, and is being built by the Penn Bridge Co.

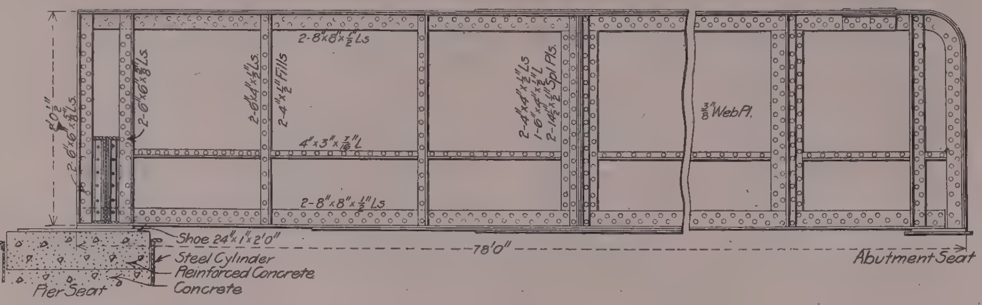
Lawrence Street Bridge, Denver.

The highway bridge across Cherry Creek, at Lawrence St., Denver, Colo., is 74 ft. wide and 156 ft. long over all and consists of two through plate girder spans skewed 42 degrees 10 minutes with their abutments. It carries a roadway about 44 ft. wide in the clear and two 12-ft. sidewalks and is proportioned for heavy city traffic. The substructure consists of two masonry abutments and four cylindrical piers in the axis of the stream and on the center transverse line of the bridge. All of the piers are made with clusters of piles having their upper ends enclosed in steel cylinders filled with concrete. Under the outside girders which carry only sidewalk loads, the piers have only three piles each and the cylinders are 3 ft. 9 in. in diameter, the two inside piers have five piles each and the cylinders are 5½ ft. in diameter. All of the cylinders are 15 ft. high, made of ⅜-in. steel lap jointed in three courses and have the upper and lower edges stiffened with outside rings made with a 4 x 3-in. angle and a 3 x 7/16-in. flat, respectively. The two 5½-ft. cylinders are not connected together, but the large and small cylinder on each side of the bridge are connected by a plate girder 3 ft. deep field-riveted to both with the top flange flush with the horizontal flange of the top ring angle. The monolithic concrete in the cylinder is capped with a slab 16 in. thick of reinforced concrete projecting 6 in. above the top of the cylinder, grouted in and covered with a steel plate on which the sole plates of the girders are seated.

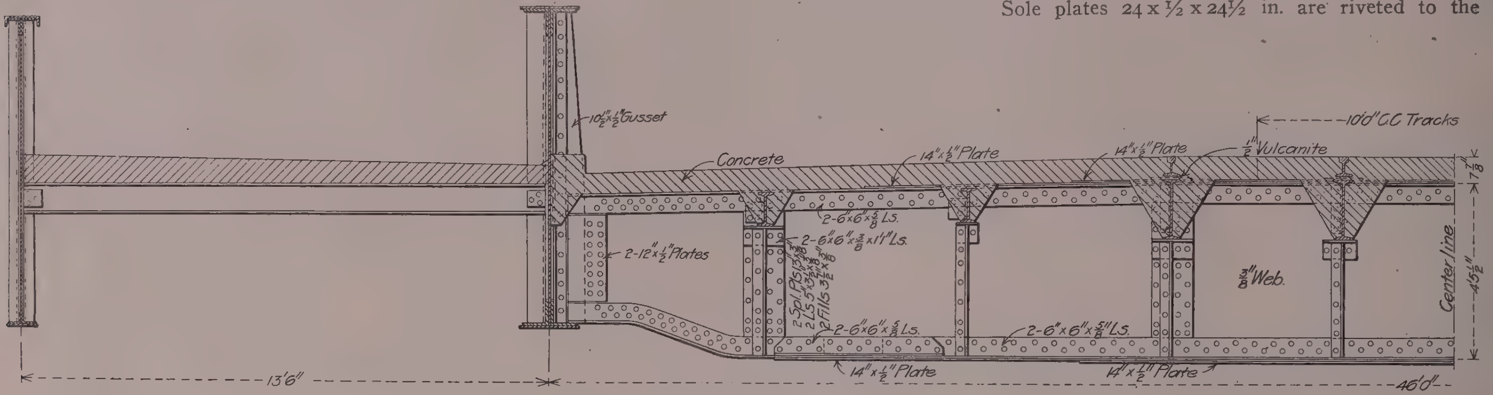
The superstructure consists of two lines of roadway girders 46 ft. apart, and two lines of sidewalk girders, 73 ft. apart on centers carrying floorbeams and stringers as indicated in the diagram, which support a solid concrete floor slab continuous from end to end of the bridge. All of the girders have square upper corners at the fixed river ends where they are anchor-bolted to the piers with about ½-in. clearance between their end vertical angles. At the shore ends the upper corners are rounded and they have sliding bearings on the abutments. All the girders are 78 ft. long and 5 ft. 9 in. above sand line in the bed of the stream.

The roadway girders are 96½ in. deep back to back of flange angles and are made with ⅜-in. web plates in lengths of 17 ft. 7 in. except in the end panels which are special on account of the skew. On the roadway side, at each splice there are two vertical web-stiffener angles with a gusset plate between them to which is field-riveted between double cover splice plates the end of the floorbeam web. On the opposite side there is a single larger vertical web-stiffener angle. Each 17½-ft. length of the web plate is subdivided into three panels by pairs of vertical web-stiffener angles with fillers. The maximum flange section consists of two 8 x 8 x ½-in. angles and two 18 x 7/16-in. cover plates.

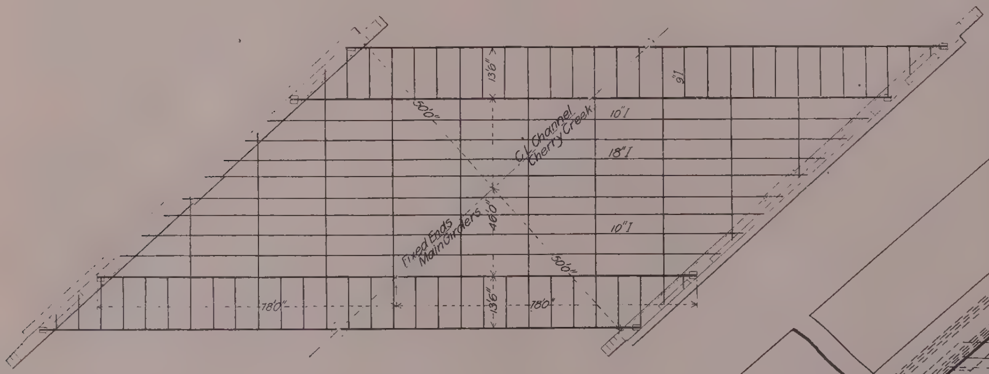
The flange angles are unspliced except in the top flange where they are cut short about 3 ft. from the abutment ends so that the rounded corners may be made with the short end vertical angles which are much more easily curved than the long angles of the same size would be and are spliced to them by short cover angles and cover plates which do not have to transmit much stress. Sole plates 24 x ½ x 24½ in. are riveted to the bottom flanges of the girders and are anchored by two 1-in. bolts through round and slotted holes at the fixed and expansion ends respectively. A horizontal 4 x 3-in. angle is riveted to the inner face of each girder about 3 ft. above the bottom flange to receive and support the edge of the concrete floor slap. The sidewalk girders are



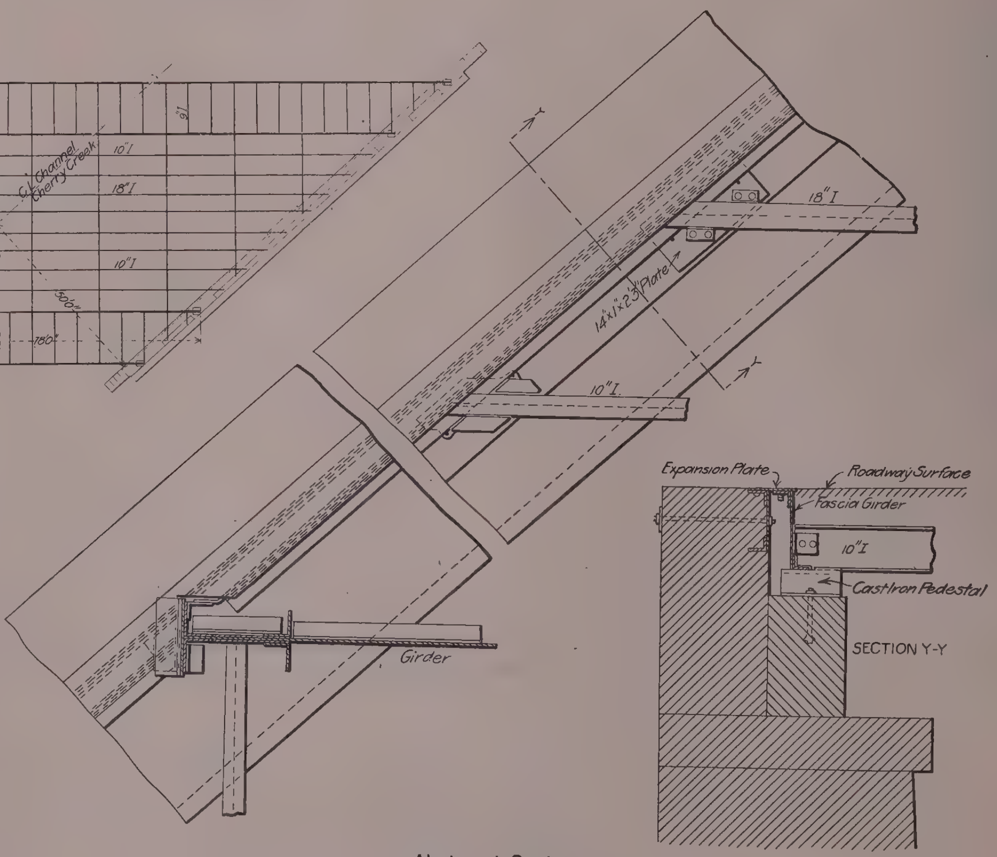
Roadway Girders.



Half-cross Section.



Arrangement of Girders and Floorbeams.



Abutment Seats.

similar to the roadway girders, but they are only 7 ft. 8½ in. deep and are made with lighter materials. The bottom flange is made with two 4 x 3 x 7/16-in. angles and one 9 x 7/16-in. cover plate 50 ft. long and the top flange is made with two 4 x 3 x 7/16-in. angles and a full length 9-in. 13⅓-lb. channel, flanges down.

The roadway girders in both spans are joined by six intermediate floorbeams 17 ft. 7 in. apart which have drop ends and bent lower flange angles, as shown in the general cross section of the bridge. They carry four lines of 10-in. I-beam stringers for the roadway and four lines of 18-in. I-beams under the street car rails. The stringers all have shelf and web connection angles and their top flanges are coped flush with the top flanges of the floorbeams, the latter being curved parallel to the crown of the roadway. The stringers support on their top flanges a continuous concrete slab 6 in. thick which is extended around their webs and lower flanges so as to completely enclose and protect them against corrosion and atmospheric action. The shorter end floorbeams are 3 ft. 7 in. deep with horizontal top and bottom flanges and are web-connected at one end to the girder and at the other end have a sole plate seated on a bed plate on the pier abutment masonry.

The abutment ends of the stringers are seated on cast pedestals and bed plates and are connected together and to the ends of the main girders by fascia girders with horizontal bottom flange, curved top flange, and Z-shape cross section made with single top and bottom flange angles on opposite sides of the web plate. The top flange angles provide a sliding bearing for the checkered cast iron apron plate which covers the expansion joint between this girder and the parallel fixed girder, 6 in. distant and is riveted to the latter. The fascia girders were assembled in position before the back walls were built and the fixed girders bolted to them. The sidewalk floors are made with continuous concrete slabs with their upper surfaces pitched to drain towards the roadway girders on each side of which there are cast iron scuppers about 35 ft. apart with gratings and copper spouts. The concrete is supported on the top flanges of 9-in. transverse I-beams about 5 ft. 10 in. apart and is extended around their lower flanges to enclose and protect them as in the roadway stringers. This bridge contains about 461,000 lbs. of steel and will leave cost about $25,000, exclusive of abutments which were previously in place. It was designed and constructed under the direction of Mr. J. B. Hunter, city engineer, and was built and erected by Mr. C. G. Sheely, Lincoln, Nebraska.

The Billboard Nuisance was taken in hand by the authorities of Chester, Pa., two years ago, who passed an ordinance forbidding the erection of any more within the city limits, on the ground that they are unsightly and very often are either a nuisance or create one. The lessee of property on which he desired to erect substantial galvanized-iron billboards has been fighting this ordinance and has just secured a favorable decision in the State Supreme Court, 61 Atl. Rep. 894. The court rules that all the city has a right to do is to prohibit the erection of insecure billboards and the exhibition of improper advertisements. It is without power to prevent the erection of unsightly billboards on private property.

Difficult Sewer Construction in Minneapolis.

Many disagreeable and annoying difficulties were encountered by the city engineering department of Minneapolis this season in constructing two main sewer trunks to serve important residence sections of the city. Both lines run through low land which was formerly the bed of the Mississippi River. When the river changed its course some hundreds of years ago to the present channel, the old course was filled up with mud and quicksands. Numerous springs are met with here and there, and even in dry seasons the district is a wet morass. Ever since the city was founded the district has been a public "dump" for stable refuse, street sweepings and all manner of refuse.

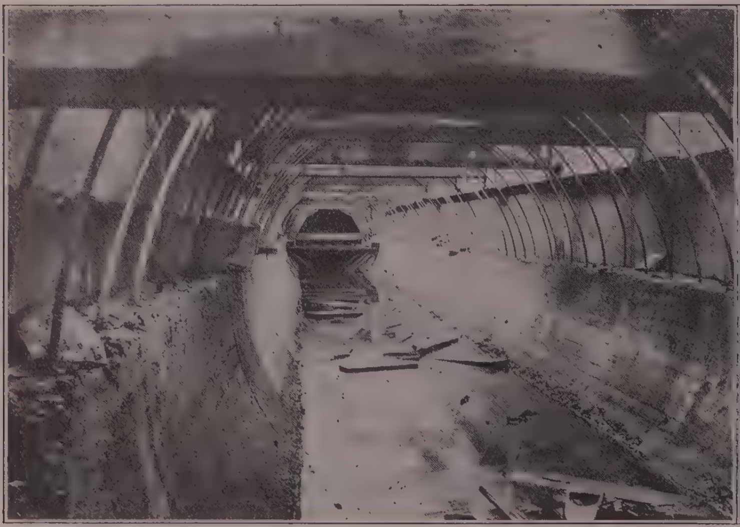
Size of Stream Pumped Continuously from Trench.

Piling in Quicksand, showing Movement of Latter.

Both sewers are of concrete construction. The concrete is mixed very wet, the proportions being one part Portland cement, three parts sand and five parts of crushed limestone. The concrete is reinforced with half-inch round steel transverse rods placed one foot apart and ⅜-in. longitudinal rods placed about a foot apart. In the smaller sewer, the concrete is 5 in. thick at the crown of the arches, and in the larger 6 in. thick. The smaller sewer was extended this season a distance of 1,400 ft. It is oval in shape and equivalent in carrying capacity to a circular 54-in. pipe. The larger sewer has a 78-in. circular section and this season's estimate called for 1,400 ft. of construction. Bassett's Creek, which drains the morass through which both sewers are being constructed, carries as much as 800 cu. ft. of water per second after a heavy rainstorm, and during the present wet season has been a good-size stream.

In order to carry the sewers it has been necessary to drive piles along the entire length. The piles vary from 16 ft. to 70 ft. in length. The piles were usually 8 x 8 in. in section, spliced for long lengths, as such timber could be secured as a rule at lower cost than ordinary piling. The piles are placed 4 ft. apart, center to center. The sheathing, which is of 2x8-in. matched lumber, is left in place, the upper 6 ft. being cut off for use in splicing the timber piles.

Water has been encountered during the entire season and it has been necessary to keep an 8-in. centrifugal pump in operation all the time. Much of the work has been done in quicksand, and this has compelled speedy action on the part of the crew and watchfulness on the part of the engineers. The quicksands rise at the bottom of the ditch, sometimes as much as 2 ft. an hour. Consequently the grillage had to be put in very rapidly, as the ground sank steadily and cracks often a hundred feet long appeared on each side of the sewer. The sheathing had to be driven about 4 ft. below the grillage and in many places the pressure was so great that the end of the sheathing below the lowest set of stringers was bent in the shape of a bow and for a considerable distance was broken off as cleanly as though cut with an axe. The stringers were 3x12 in.



Completed Invert of Sewer.

Sheathing for a Quicksand Trench.

Notwithstanding the difficulties, the average advance was 25 ft. per day of eight hours. The cost has been about $15 per linear foot. To the men the work was made unusually disagreeable by the water which seeped through from the dumping grounds above, and which carried a stench noticeable for a long distance. Mr. Carl Ilstrup, the engineer in charge of the work, says that the sewers are the most difficult propositions he has had to meet in his twenty-four years' connection with the Minneapolis engineering department.

Fires Due to Electricity during the quarter ending Oct. 10 were 115 in number and entailed a loss of $256,403, according to a report of the National Board of Fire Underwriters. Two crosses between high and low-potential circuits and nine between light or power wires and signalling systems were reported. Twenty fires were reported as due to short circuits in interior wiring and 22 as caused by the accidental grounding of circuits. Reports were also received of 82 fires causing a loss of $959,302, supposed to have been due to electricity, but these are not included in the Board's statements because the causes could not be definitely proved. In view of these figures it seems evident that the electrical installations in a building ought to be made under the direction of some competent specialist, and not left by the architect to the contractor.

Thawing Ground in Alaska.

One who has never visited the interior of Alaska, says Mr. C. W. Purington in a bulletin recently published by the U. S. Geological Survey, finds it difficult to conceive the formidable condition of solidly and perpetually frozen alluvium which is there encountered by the placer miner. The quantity of water in the form of ice which occurs in the frozen gravel averages about 25 per cent.; while in the overlying fine, black silt which forms the overburden the quantity of ice varies from 50 to 75 per cent. Whatever may be the physical composition of the material, it forms a mass as solid and as difficult to penetrate as solid stone, and can be disintegrated only by exposure to the sun's rays or by the long-continued application of some form of energy artificially applied.

In any open-cut operations the dense blanket of moss, from 12 to 18 in. in thickness, which covers the frozen ground, must be broken into and turned over either by adzes or plows before the action of sun and water can take any effect on the underlying muck. This effect is remarkably rapid when the water is allowed to run over the exposed black and icy mass. A curious condition exists in the treeless areas of Seward Peninsula. Wherever a growth of stunted willows occurs, the ground beneath is found to be thawed, and wherever the willows are replaced by moss the ground is frozen solid. The rule is not without exceptions, but has been found to have rather general application.

Drifting operations in the creek deposits of some districts of the interior are nearly always carried on in solidly and perpetually frozen ground. A necessary accompaniment of the work is the thawing of the ground by artificial means. The method of thawing gravel underground by wood fires is expensive and, unless the conditions are very exceptional, is not used in those districts where transportation facilities permit the bringing in of boilers.

According to experience in one district the efficiency of a good fire in creek ground was as follows: A fire taking three-fifths cord of wood (at $12 a cord) is built against the face of the bank. The pile of wood will be 18 in. wide, 2 ft. high and 25 ft. long. Stones are laid up over the pile and a space is left to light the fire. The fire is lighted at 5 p.m. and left to burn until 8 a.m. the next day. The stones, which quickly get hot, are regarded as most efficient in thawing. On a 4-ft. thickness of pay gravel this amount of fire will thaw, in the time specified, from 5 to 6 cu. yd. This is at the rate of 9.2 cu. yd. thawed to the cord of wood, which is considerably less efficient than the method of thawing with steam. Time, delays and awkwardness of the method, moreover, make wood fire thawing the most expensive that can be adopted. The figures per foot for shaft sinking range from $3.16 to $7.50 in taking gravel from prospect shafts. The efficiency given in the above-cited case appears to be very nearly the same as that given by Mr. E. D. Levat for the operations in eastern Siberia.

The direct application of jets of dry steam to the gravel bank through the agency of driven pipes has been found to be the most efficient method in general practice for thawing frozen gravel. The amount of moisture contained in steam can be judged by the color of a jet of steam issuing from a small brass pet cock. If it is transparent or whitish near the orifice it contains less than 2 per cent. of moisture; if pure white, the moisture is above 2 per cent. A ¾-in. steam hose is run from the boiler to the bank, where it ends in a manifold to which several ½-in. hose lines can be coupled. Each of these small lines ends in a hollow bar about 5 ft. long with a tool-steel point which is driven into the gravel and enables the jet of steam to penetrate far into the interior of the frozen mass.

In creek claims exceeding 15 ft. in depth, where solidly frozen ground occurs, the method of drifting with the use of the steam point is as follows: A 20-h.p. boiler, capable of running 10 steam points, is put on the ground, and frequently one or two extra long points are provided for sinking holes. These long points, from 10 to 12 ft. in length, are not so strongly made as the 5-ft. points used in the drifting operations. In some cases pieces of one-half-inch hydraulic pipe are used. The point is set up on the ground and steam or hot water is turned on. The time for sinking a hole by this method to bed rock is from twenty-four to forty-eight hours. If large, flat stones are encountered in the gravel underlying the muck it is sometimes advisable to use strong, specially made points to prevent breaking. The average radius of a vertical shaft thus thawed by a single point is 2 ft., and the hole when cleaned out has a cylindrical or tube shape.

If timbering is required after the shaft is sunk it is generally found that the hole will thaw sufficiently to allow the shaft to be carried 4 x 5 ft. or 4 x 6 ft. inside the timbers. As a rule, however, winter shafts are not timbered. When bed rock is reached a tunnel or runway is run for a distance varying from 50 to 100 ft. from the tunnel lengthwise of the claim. From this central drift, which is generally timbered, lateral drifts are run to a distance not exceeding 50 ft., or from this down to 10 ft., or the width of the pay streak. Two tunnels parallel with the central runway are carried at the ends of the cross drifts and connections made from them to the shaft. These are rarely timbered.

The frozen condition of the overburden allows a firm roof to stand without timbering while the gravel is being extracted. This is a great advantage and in part offsets the difficulties attending the breaking up of the frozen gravel. The ground is now ready for working. The drifts and main ways are run as low as possible in cases where the pay is thin, but a height of 3½ ft. is the lowest that can be worked with economy.

During the night shift sufficient gravel is thawed to occupy the men in extracting it in the daytime. Points 5 ft. in length are used to thaw the gravel and are generally used in batteries of four. The points are driven in with a mallet by the point man working on the night shift. The points are left in the bank from ten to fourteen hours. Each point thaws a block of gravel on an average of 6 ft. into the bank, 18 in. on each side of the point and 4 ft. high.

It is considered good practice as a rule to start the points with hot water turned through the hose. The points must be driven carefully and slowly, and for 10 points distributed along a face the average time needed is from one to three hours. The amount of steam required for each point has been found to vary in amount from 1 to 2 boiler horse-power. The amount of gravel which a point will thaw appears to vary with the length of the point, and this is regulated somewhat by the character of the gravel. The 5-ft. point has been found most economical.

A typical illustration of the efficiency of the points is the following: Points of Dawson manufacture, 5 ft. long, costing $15 each laid down, were used in manifolds of four. They were put in at distances of from 2 ft. 6 in. to 3 ft. apart. The points were started with hot water and it took three hours to drive them in. A 12-h.p. boiler supplied the steam for 10 points, three-fourths of a cord of wood being burned on the night shift, when the thawing was done. In twelve hours the 10 points thawed a block of gravel 30 ft. in length by 5 ft. in height by 6 ft. into the bank—an average of 3.3 cu. yd. to the point.

A Reinforced Concrete Culvert.

Two tracks of one of the interurban electric lines of the Philadelphia Rapid Transit Co. cross a small stream in Delaware County, Pa., on a fill about 23 ft. high, through which the reinforced-concrete, elliptical-arch culvert shown in the accompanying illustration has been built. The culvert is built on a skew and is 100 ft. long. It has a span of 21 ft. normal to its axis, or 33 ft. on the skew, a rise of 16 ft. and is 6 in. thick at the crown and 11 in. thick at the haunches. Its skewbacks are 3 ft. high and are widened from 11 in. at the haunches of the arch to 4 ft. at their bases, which rest on a rock foundation. Continuous transverse rods, extending from one skewback up through the arch and down into the other skewback, are designed to relieve any tension on the concrete. Two rows of longitudinal rods, one near the intrados and one near the extrados of the arch, provide for the distribution and delation of the loads. The skewbacks are not tied together by horizontal rods, nor is a concrete floor laid in the culvert. The rubble-masonry wing and spandrel walls have but one thickness of stone and are built entirely independent of the arch.

Re-Inforced-Concrete Culvert. Delaware County, Pa.

The centering consists of matched flooring, laid longitudinally on heavy templates placed closely enough together to avoid any danger of deformation of the arch while the concrete was setting. The arch was build in 5 sections, one section being finished in a day. Two gangs of laborers were employed and the concrete brought up on both sides of the arch at the same rate, in order to balance the thrusts. Plain round rods were used for reinforcement, about 2½ lb. being required per foot. The concrete was mixed wet by hand in the proportion of 1 part Vulcanite Portland cement, 3 parts sand and 5 parts ⅛ to ½-in. broken stone. The culvert, including the arch and skewback contains approximately 135 cu. yd. of concrete, or 1.35 cu. yd. per foot of length. It was built by the Reinforced Cement Construction Co., of New York City.

THE BLAST FURNACES of this country have an annual capacity of 28,635,000 tons, according to James M. Swank, and the production is now nearly at that rate.

Book Notes.

The "Mechanical World Pocket Diary for 1906" is the nineteenth annual edition of this valuable book, which is by no means so well known to American engineers as its usefulness warrants. The tables and memoranda cover all fields of mechanical engineering, and their number and extent is surprising in view of the low price at which the book is sold. New sections have been added on the steam turbine, refrigerating machinery and high-grade tool steel. Most of the standards recommended by the Engineering Standards Committee are given, although a few of much importance, like pipe flanges, are omitted. As a whole the book is a remarkable piece of editorial work, which has achieved an enviable success in Great Britain, and deserves the same favor in the United States. Books of this character, which serve the double purpose of diary and reference manual, have a special field of usefulness which has not been recognized by American publishers, except the Westinghouse Electric & Mfg. Co. and the American Bridge Co., whose diaries, good as they are in their special fields, are hardly in the same class with this one. (Manchester, Eng., Emmott & Co., 6d. net.)

The use of dredges in gold mining has now become so widespread and well studied that a large amount of useful information on the subject has appeared in mining journals and the publications of engineering societies. Capt. C. C. Longridge has gone over this field carefully and compiled from it a volume on "Gold Dredging" that will be of interest to the many investors in such enterprises. The illustrations, in the proportion of one page to each four of text, are excellent and give a good idea of many features of such dredging which no amount of description could make clear. The types of dredges used in gold mining, the methods of separating the gold from the gravel and dirt, the disposal of the tailings, the management of the machinery, the use of centrifugal dredging equipment, and the prospecting of underwater gold-bearing properties are among the subjects discussed at considerable length. The author's enthusiasm for this method of obtaining gold is evident throughout the book, and is doubtless justified by the results obtained in many places. Dredging is now attracting more attention than any other gold mining system, and the appearance of this book is manifestly timely. (London, The Mining Journal.)

The study of the occurrence of chlorine in water is one of the most interesting features of analytical work covering a considerable territory. Salt is one of the indications of sewage contamination, and a comparison of the salt content of any water under examination with the normal chlorine in the waters of that region affords an indication of the pollution the water may have experienced. This is due to three facts; first, the animal body expels the same amount of salt that it absorbs; second, this salt is unchangeable in the soil and is very soluble in water; third, it must eventually form a part of the drainage and become mixed with the general runoff of the region in which it is expelled. In order that the determination of the salt, or the chlorine forming it, may give definite information, it is necessary to know the amount of chlorine in the water before pollution, and consequently much attention has been paid lately to ascertaining the extent to which this element occurs in uncontaminated water in various sections of the country. Probably the most comprehensive discussion of the subject yet undertaken is given in Mr. D. D. Jackson's "Normal Distribution of Chlorine," recently published by the U. S. Geological Survey. The author explains the importance of this element in the interpretation of a water analysis and the method of determining the amount present in a sample of water. He then gives the results of examinations of unpolluted water in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut and New York, and from these data presents maps showing by curves the normal amount of chlorine in all parts of these States. These maps are of practical value to the chemist and engineer in determining the degree of pollution indicated by the chlorine in a sample of water obtained in this part of the country.

A POCKET-BOOK OF MECHANICAL ENGINEERING. By Charles M. Sames. Jersey City, N. J., published by the Author, 448 Jersey Ave.; flexible leather, 16mo., 176 pp., $1.50.

A real pocket-book that will actually fit the pocket and is marked by condensation of data rather than the opposite, has at last appeared. It contains chapters on mathematics, chemical data, engineering materials, structures and machine parts, energy and the transmission of power, heat and the steam engine, hydraulics and hydraulic machinery, shop data and electrotechnics. Tables, important data, formulas, statements of theory, examples and explanations of graphical methods of obtaining results are used by the author in covering these subjects, his purpose being to afford the information required by a technically trained engineer in solving a mechanical problem, rather than a treatise or textbook. By editing the information with this object in view he has produced a book that is, in a degree, what many engineers and draftsmen have long desired. In the process of condensation he has occasionally lost all sense of proportion, however, as in the paragraph on mechanical stoking, which gives data on only one kind of apparatus and nothing of much importance at that. Such faults are inevitable in the first edition of a book of this character, but the fundamental principle on which the compilation has been made is so good that these blemishes should be eliminated as soon as possible. There is a demand for a real mechanical engineering pocket-book suited for American conditions, and this little volume, the first attempt to answer this demand, deserves encouragement in consequence.

Letters to the Editor.

A COLLAPSIBLE STEEL CENTER FOR CONCRETE SEWERS.

SIR: I enclose herewith a drawing of a new steel collapsible form for building concrete sewers, designed by myself. Fig. 1 shows the steel form in place with the concrete around it. Fig. 2 shows the form collapsed, ready for withdrawal. The form illustrated is composed of a framework of angle irons having a smooth skin of light sheet steel riveted thereto. The lower part of the frame is jointed at the bottom and is extended or collapsed by means of the cross struts which are provided with turn-buckles, as shown. When the sides are drawn inward the arched top will fall until it rests on the free edges of the lower part and the whole form may be withdrawn and reset again in its original shape or contour.

If desired, the top piece may be first drawn entirely out, sliding on the free edges of the lower section, which is stiffened by small angle irons riveted on the edge but not shown in the sketch.

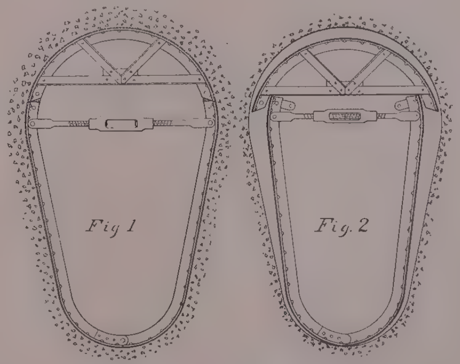
When in place the upper and lower sections are connected by short clips which bind the parts together and hold them in true alignment. By removing the bolts in the upper ends of these clips they may be turned down and out of the way.

This principle of construction may be used in a sewer of a circular form, as well as in the egg-shaped shown in the sketch. Having a framework of angles, this form will be greatly strengthened and held in true shape, and being separable into three parts will make it more portable and easy to handle in transportation.

Very truly yours, THOS. C. HARRIS.
Baltimore, Nov. 14.

SMALL MUNICIPAL ASPHALT REPAIR PLANTS.

SIR: It seems to me from observation of several successful endeavors on the part of small cities to repair their asphalt pavements that the subject deserves carful attention in making up appropriations for the coming season's public work. There are many cities which have small amounts of asphalt pavement in service giving good satisfaction, but these pavements have places that need repair, as is the case with all street pavements. These poor places may be due to a variety of causes, which it is hardly necessary to discuss, particularly as this has been done at length in Mr. Richardson's excellent book. As a rule these pavements are still supposed to be covered by a guarantee, but as there is no asphalt plant in the place, the work having been done by a railroad plant, it is necessary to wait until the contractors have enough repairs to warrant their bringing a plant to the city to make them. Consequently the street surfaces are allowed to fall into a condition which is really needlessly unsatisfactory. Moreover, the condition of the pavements is much improved if these bad places are not left to be hammered larger by the traffic over them, but are repaired as soon as they become noticeable.



Collapsible Form for Concrete Sewers.

Now that all the materials for an asphalt pavement can be obtained at a reasonable figure from numerous dealers and it is not difficult to secure a foreman to superintend the handling of a small plant, it seems to me that it will be a good thing for cities to keep an asphalt repair gang in service where there is difficulty in having repairs made by contracts. If this is done the expense will not be very great, and the most serious objection to asphalt pavement for small cities will disappear. These pavements offer decided advantages in a number of sections of the country where good paving brick cannot be obtained readily at a reasonable figure, and after observing the condition of pavements of all classes in numerous cities I am thoroughly convinced that asphalt pavements will come into extensive use as soon as municipal officers learn to repair them, and possibly to lay them. They are the cleanest and least noisy pavements to be had, and when engineers get over their present inclination to consider their construction a deep secret, only to be mastered by prolonged study in a chemical laboratory, asphalt will find greater favor for small places. The construction demands good materials and intelligent supervision, but both are to be had by cities as well as private companies.

Yours truly, WILLIAM FEATHERSTONE.
Cleveland, Nov. 22.

BRIDGE SEATS.

SIR: In connection with the recent discussion in your columns respecting the use of lead and other materials in seating heavy bed-plates, I would like to recall attention to the method employed in setting the saddle plates on the first East River bridge. These were about 16 ft. by 8 ft. in size. The stone underneath was cut by pointing to a level surface, allowing about one-half inch for beds of cement mortar. This was mixed one cement to two sand, just stiff enough not to run, and carefully struck off level and of the right thickness. The plates were then carefully lowered, and rammed sufficiently to obtain full contact with the mortar.

I cannot see how this can be improved upon; as there is perfect contact, abundant bearing power, sufficient adhesion and no danger from rust.

F. COLLINGWOOD.
Elizabeth, Nov. 22.

EXPERIMENTAL INVESTIGATIONS BY CITIES.

SIR: In your issue of November 18 you refer to the recent experimental investigations made by the City of Columbus to determine the best methods of treating the water and sewage of that city, and refer to the credit due to Mr. Julian Griggs, city engineer, for carrying through the work. A somewhat extensive experience in municipal engineering affairs leads me to believe that a great deal of credit is also due to the Board of Public Service of that city for authorizing the investigations referred to.

It is generally the case, as is too well known, that the city engineer is desirous of having such studies, but his official superiors are opposed to them, not only on the ground of their expense but also because they believe that the salary paid to the engineer ought to give the best expert advice on all engineering subjects. There are engineers of my acquaintance who would not care to run the risk of asking for appropriations for experimental work or consulting advice, knowing that to do so would be to detract from the force of their recommendations on every subject that came before them for an opinion.

It seems to me that a discussion of the proper way in which to guide a public board in handling technical subjects would be a valuable thing to have. Of course it would hardly be appropriate for the columns of a paper devoted solely to engineering subjects, yet the most serious obstacle to progress in municipal engineering at the present day is certainly the failure of such boards and committees to recognize the importance of the technical subjects over which they have final authority.

As a rule these men who have final authority give but a few hours a week to their public duties, and the variety of subjects coming before them for decision is so great that there is a tendency to defer action on everything they are not entirely acquainted with. The result is very little help from them for the city engineer. It is for this reason that the Columbus board deserves applause for allowing its engineer to follow an excellent plan in connection with the great public works in that city. We have some pretty important problems in this place, and I should like to have some expert studies made before they are undertaken, but up to the present time the committe in charge has absolutely refused to call in outside advice.

Yours truly,

CITY ENGINEER.

[The Engineering Record has noticed that some of the most successful city engineers do not bother their boards with technical reports these gentlemen cannot understand; possibly the requests for expert advice are not prepared so as to appeal strongly to business men.]

CURRENT NEWS SUPPLEMENT

DECEMBER 2, 1905.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, meeting, Dec. 6; paper on New Graving Dock, at Nagaski, Japan.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York Next meeting, Dec. 15, 44 West 27th St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk Street, Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers.. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

American Society of Refrigerating Engineers. Sec-Annual meeting, Dec. 4-5; 12 West 31st St., New York.

National Association of Manufacturers of Sand-Lime Products. Secretary, H. A. Duerr, Wilmington, Del. Next meeting, Dec. 5-7, Detroit.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia, Pa.

HYDRAULIC MACHINERY FOR MAKING CONCRETE BLOCKS.

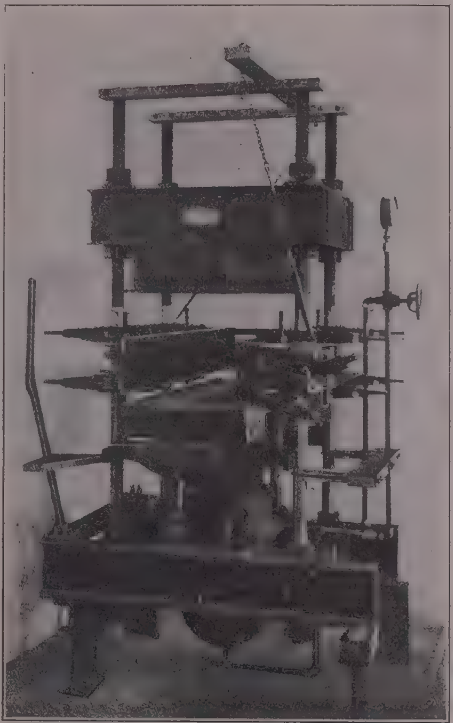
The Fisher Hydraulic Stone & Machinery Co., a Maryland corporation, was organized a few months ago to place on the market a system of hydraulic power machinery for the manufacture of concrete stone for all purposes. This machinery was devised by Mr. W. H. Fisher, president of the company, and consists of a hydraulic pump of novel design and purpose and a hydraulic press in which the blocks are formed.

The hydraulic pump has four plungers, ingeniously arranged to come into and go out of action automatically, and thus cause the press to operate with a very heavy pounding, jarring motion. The hydraulic press, shown in the accompanying illustration, is operated from beneath. When set up, the platen, or platform, is level with the floor. The steel-car mould box is loaded with concrete and run on a track onto the platen. The ends of the retaining box are then closed, and their closing brings the sides of the retaining box strongly against the sides of the mould box. The latter is thus reinforced on ends and sides to withstand the immense pressure without distortion. The retaining box is attached to the platen and rises and falls with it along the steel columns which support the top of the press.

The operator closes the operating valve and the reinforced mould box is lifted until it reaches the pressure heads. When resistance is met the pumps begin to act as heretofore described and the mould box is lifted suddenly and with great force, so that the pressure heads pound, jar and settle the mortar, thus filling in all voids and loose places. This pounding continues for about 12 seconds. A long, heavy stroke of 200 tons finishes the pressing. The compression thus secured is stated to amount to 30 per cent. of the original mass.

The operator stops the pressure at will; the mould box falls back to its level, the ends of the retaining box are thrown open and the car is passed out on the tracks to the curing bed. This whole operation has consumed less than one minute. Other cars follow and one can be pressed every minute in the day if loaded and brought to the press fast enough.

The steel-car mould box is mounted on steel trucks and the sides and ends are arranged to open and lower. The green concrete masses, still quite soft, are lowered without jarring or breaking, due partly to a false bottom, which maintains a perfect rigidity. The green stones now rest on wooden pallets which have been placed against the sides of the mould box when it was loaded; they are lifted on these pallets and placed on the curing bed and the car is run around back to the fillers. The use over and over again of these wooden pallets, costing only a few cents each, is quite an economy. The mould box is arranged for making stones of any size and shape, by using partitions, dividers, fillers and cores. A description of the manner of making a stone with a convex corner will explain how any shape is secured. One or more boards are sawed and shaped to fill in one corner of the mould box, which has been partitioned to width and length. The other part of the board is cut off to length and placed on the concrete. The convex corner is already of the proper shape and thus it serves as an extension pressure head. The angle fillers may be faced with tin or other smooth metal, if necessary. The entire mould box is 68½ x 19½ x 9 in. and a single stone of this full size can be made if desired.


HYDRAULIC PRESS FOR CONCRETE BLOCKS.

Density is undoubtedly one essential element of great strength and durability in concrete blocks. This is secured by the very heavy pounding and pressure—50,000 lb. to the square foot. There are no soft, weak spots and voids in the product, and the texture and strength of the stone is the same throughout. The corners and edges, having received the same pounding and pressure, are sharp and as strong and hard as the remainder of the stone. Every stone produced has gone through identically the same process, hence one stone is like another and such remains the case as long as the same materials are used. It has been found that the great compression prevents shrinking and cracking. The stones do not warp, crack or alter in shape.

The American Hydraulic Stone Co., Century Bldg., Denver, Colo., has issued a pamphlet containing illustrations of a number of important buildings of various types constructed of two-piece blocks in accordance with its patented methods. This system is different from most concrete block methods, and is in use from New England to the Pacific Coast.

THE FIRE RESISTANCE OF CONCRETE.

Some interesting tests of the fire-resistance of concrete have been made by the British Fire-Prevention Committee. whose experimental investigations of fire-retarding construction have been mentioned many times in this journal. These tests were made on Oct. 24 and 25 under the direction of committees made up of architects, engineers and public officials. The official report of them has not been received, but the following account from "Engineering" gives a good idea of the scope and results of the experiments. The subject is of particular importance to London architects and builders just now because new rules regarding the use of concrete have recently gone into effect.

The first of the committee's tests was with a floor (22 ft. x 10 ft.) comprising seven separate bays of concrete, the bays being supported by ordinary 6-in. rolled iron joists encased with concrete. The concrete aggregates utilized for encasing the joists were identical throughout—namely, a coke-breeze concrete (5 to 1)—but the bays were each made with a concrete of a different aggregate for the purpose of obtaining comparative results. Each bay showed an exposed surface of 10 ft. x 2 ft. 7 in. and was 5 in. thick, and the bays comprised respectively slag concrete, broken-brick concrete, granite concrete, burnt-ballast concrete, coke-breeze concrete, clinker concrete, and Thames-ballast concrete. In each case there was 1 part of Portland cement to 5 parts of other substance. Thus there was 1 part of cement to 3 three parts furnace slag and 2 parts of sand in the slag concrete; 1 part of cement to 3 parts of broken brick and 2 parts of sand in the broken-brick concrete; 1 part cement to 3 parts of broken granite and 2 parts sand in the granite concrete; 1 part cement to 3 parts furnace clinker to 2 parts sand in the clinker concrete; 1 part cement to 3 parts Thames ballast and 2 parts sand in the Thames-ballast concrete; whilst the burnt ballast and coke-breeze concrete were of 1 part cement to 5 parts of burnt ballast and coke breeze respectively. The concrete aggregates were put in fairly wet, the time allowed for setting and drying was six weeks, and the bays were loaded at 2 cwt. per foot super.

The test to which the concrete bays were subjected was the application of fire for a period of three hours, gradually increasing in temperature to over 1,800 deg. Fahr., followed by the application of water from a steam fire-engine for two minutes.

It has certainly been fairly proved that Thames-ballast concrete is most unsuitable for fire-resisting purposes. Of the various bays the Thames-ballast concrete bay was certainly the failure, and this although, as should be specially remarked, the Thames ballast had been passed through a 1½-in. ring, whilst, as a rule, Thames ballast, as used in concrete, is somewhat larger in size. The concrete was broken away, was disintegrated, and the bay deflected 2 in. in the 2-ft. 7-in. span, at the same time being badly cracked all over.

The two great successes in the ordeal were, in our opinion, the clinker and the coke-breeze concrete. Next in order of success were the broken-brick concrete and the furnace-slag concrete, the slag being from some iron works in Northampton, bought in the ordinary way through a builders' merchant.

The broken-granite concrete was more successful than one would generally anticipate; but this was due mainly to the safeguard that all granite was put through a ¾-in. ring, which practically means that the granite was what the trade generally terms "granite chips." The burnt-ballast concrete did not appear at all satisfactory, though by no means as bad as the Thames-ballast concrete.

Speaking generally, concrete, as such, has certainly scored a very great record in these tests. It was well known, of course, that concrete is a most useful fire-resisting material if of proper aggregate and properly applied, but that it is necessary to differentiate nicely between the different aggregates. But what has, however, been particularly proved, further, in respect to these concrete aggregates is the great advantage of using a first-class cement, and it would thus be well to mention that the cement used in all the bays was identical, and was cement made by the Associated Portland Cement Manufacturers, Limited, known as "ferro-crete" cement. This cement is of very fine grinding, the residue on a sieve with 32,400 meshes per square inch not exceeding 14 per cent. The minimum of expansion in this cement does not exceed 2 millimetres under the Chatelier test, and the tensile strength was considerable, both in the neat-cement test and sand test. Had it not been for the excellence of the cement, all the bays must have made a worse showing under such a severe ordeal of fire and water, and no doubt both the Thames-ballast and burnt-ballast bays would have collapsed.

The committee's second test was with a reinforced-concrete floor on the Coignet system, this special floor attaining classification under the committee's standard as "fully protective," which means that it withstood a test of not less than 2½ hours' duration at temperatures rising above 1,800 deg. Fahr., followed by the application of water for two minutes, the floor being under a load of not less than 2 cwt. per square foot. As a matter of fact, the test was extended to three hours, and the load was somewhat higher than required under the standard—*i. e.*, 2½ cwt. per foot.

The Coignet system is too well known for general construction work to require special description here, excepting perhaps to point out that it lends itself particularly to fire-resisting construction, owing to the strength of the upper members in the horizontal beams, a point of considerable importance when the lower members become affected by the impingement of flame.

The floor covered a testing-chamber measuring 22 ft. by 15 ft., and was divided into three bays. The concrete aggregate was clinker concrete, in which the same "ferro-crete" cement was used as referred to above, and the cement again being provided by the Associated Portland Cement Manufacturers, Limited, six weeks being allowed for setting and drying.

The theory put forward by those best conversant with the subject of the fire resistance of armored concrete and so recently developed in the Fire Office Rules, was practically demonstrated, for it was shown that great care must be taken with the protection of steel rods, even if a clinker concrete aggregate is used, as was the [illegible] here. The Fire Office Rules are certainly not too stringent when they require 2 in. of protection around the bars of 1 in. thickness and upwards, and a protection equal to twice the diameter of a bar for the thinner members, the minimum protection being 1 in. As a matter of fact the minimum protection should be 1½ in.

The Wellman-Seaver-Morgan Co., Cleveland, Ohio, is publishing in sectional form a really magnificent book on the equipment of iron and steel works. The last section to appear is devoted to cranes of many types. Among the standard equipment of this sort are electric overhead traveling cranes, ladle and hot metal cranes, bucket-handling cranes for ore and other loose materials, coke handling cranes, gantry and yard cranes, shipyard cranes and locomotive cranes. The company also designs and builds special equipment like charging and manipulating cranes for steel plant work, ingot extracting cranes, soaking pit cranes and others too numerous to mention. This book illustrates all of the types with excellent engravings, which are accompanied by sufficient text to explain the purpose of each type and its leading features.

TERMINALS OF THE MANHATTAN BRIDGE.

The Bridge Department of the city of New York has sent to the Board of Estimate and Apportionment plans for the terminals of the Manhattan Bridge. In several respects these terminals present very difficult problems, requiring as much real engineering judgment for their solution as the suspended structure. Accompanying the plans was the following memorandum:

The earliest designs for a bridge across the East River at the site of the Manhattan Bridge provided for a central and unobstructed roadway in the middle of the bridge and in continuation of an extension of Flatbush Ave., Brooklyn, and this has been persistently adhered to in all subsequent plans for the bridge.

The width of the bridge was made 120 ft., including a central roadway 35 ft. in width, two spaces, one on each side of this roadway, for railway tracks, these tracks to be placed in two stories, one above the other, and two sidewalks for pedestrians, one on each side of the bridge. It was originally intended to use the two tracks on the lower or roadway floor for trolley cars alone, and the two tracks on the upper floor for elevated trains alone. It has since developed that the elevated tracks may not be extended beyond the terminals in Manhattan, and a subway route has been laid out by the Rapid Transit Railroad Commission through the Flatbush Ave. extension, over the Manhattan Bridge and through Canal St. in Manhattan. The subway routes can only be carried on the bridge with a grade of 5 per cent. at the terminals, and these routes on the bridge must occupy a portion of the lower floor on the bridge since the grades to reach the upper floor would be prohibitory.

The space on the bridge has therefore been divided as follows: 1, a central roadway 35 ft. in width; 2, two footwalks, each 12 ft. in width, on the north and south sides of the bridge; 3, a double-track subway route on the north tracks of the main floor for the Manhattan Bridge route of the Rapid Transit Commission; 4, a double-track trolley line on the south tracks of the main floor for Brooklyn trolley cars running to the Manhattan terminal; 5, a double-track trolley line on the north tracks of the upper floor for Manhattan trolley cars running to the Brooklyn terminal; 6, a double-track elevated railroad line on the south tracks of the upper floor for Brooklyn elevated railroad trains running to the Manhattan terminal.

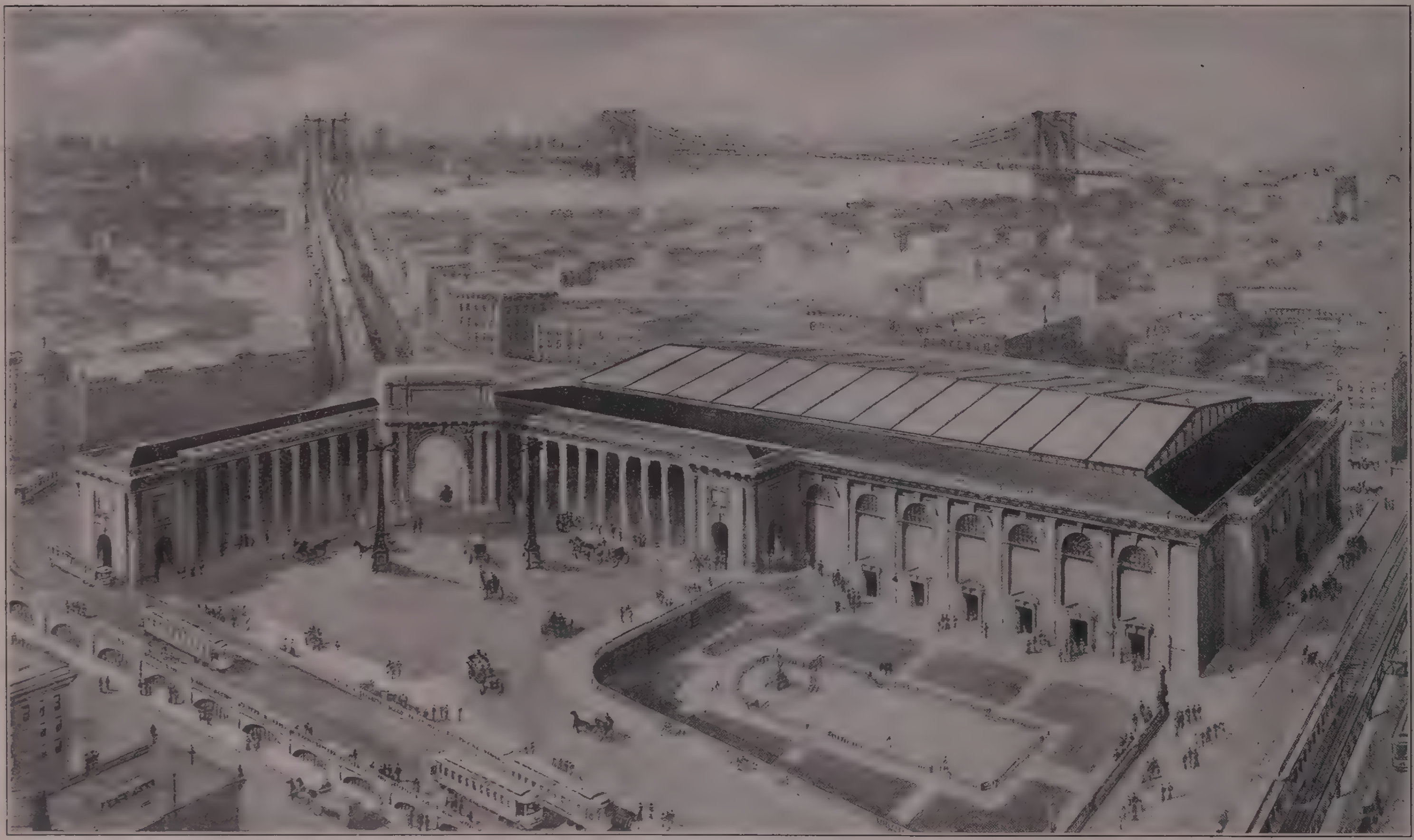
The plans have been worked out as to lines and grades so as to furnish: (a), A central unobstructed roadway across the bridge; (b) connections as above outlined for subways, surface and elevated railways; (c), provision for the pedestrians crossing on the outside footwalks, which footwalks will terminate generally on the lateral streets and keep the pedestrians entirely away from the car and vehicular traffic.

The general idea of both the terminals is the same; to furnish masonry walls enclosing the terminals, bounded in Manhattan by the Bowery, Bayard St., Forsyth St., and Canal St., and in Brooklyn by Nassau St., Bridge St., Sands St., and Jay St.

The terminal building on the Manhattan side, which is on Bayard St. and the end on the Bowery, will furnish on the ground floor an assembly room for persons about to take trains over the bridge, on the second floor ten terminal loops for Brooklyn trolley cars, and on the third floor at least four tracks and five platforms for the elevated trains from Brooklyn.

The terminal building on the Brooklyn side, with its end on Bridge St. and its side on Sands St., will furnish five terminal loops for trolley cars from Manhattan. The Brooklyn trolley lines may approach the bridge either through the Flatbush Ave. extension or through Jay St., and pass along Jay St. onto the bridge. The elevated trains from Brooklyn will pass through Jay St. or private property onto the bridge terminal and pass over the trolley tracks along Jay St. onto the bridge.

The entire terminals have been worked out with a view to fit architectural treatment, and will, it is believed, present in their open spaces and the architectural treatment of the buildings thereon, ornamental as well as convenient terminals to the bridge.



THE PROPOSED MANHATTAN TERMINAL OF THE MANHATTAN BRIDGE ACROSS THE EAST RIVER, NEW YORK.

LONG KILNS FOR THE CHICAGO PORTLAND CEMENT CO.

The Chicago Portland Cement Co. has ordered of the Allis-Chalmers Co. of Milwaukee two new rotary kilns, each to be 136 ft. long, for its plant near La Salle, Ill., and extensions for four of the 60-ft. kilns now in the plant, which will make these kilns each 136 ft. long when they are reconstructed. The building of rotary kilns for cement making of much greater lengths than was formerly common, was inaugurated by Thomas A. Edison, when he put 150-ft. kilns in his plant in New Jersey a few years ago. Since then the Allis-Chalmers Co. has built a considerable number of kilns of 100 and 125 ft. in length, but those now ordered by the Chicago Portland Cement Co. are the first that they have designed 136 ft. in length.

The new kilns will be 7 ft. in diameter for the first 70 ft. of their length. Then will come a tapering section 9 ft. 11 in. long, reducing the size to 6 ft., and this diameter will be continued for the 56 ft. 1 in. of remaining length. Each kiln will have four riding rings, with steel tires and the necessary driving mechanism. All of this apparatus will be built extra heavy and in proportion to the great length and weight of the kilns.

The extensions for the four older kilns will each be 94 ft. long, utilizing 42 ft. of the 6-ft. sections of the present kilns. They will be 7 ft. in diameter for 70 ft., the taper portion will be 9 ft. 11 in. long and then they will run for 14 ft. 1 in. at 6-ft. diameter until they join the older parts. Each extension will have two riding rings and tires. The order also includes six new front hoods for the kilns.

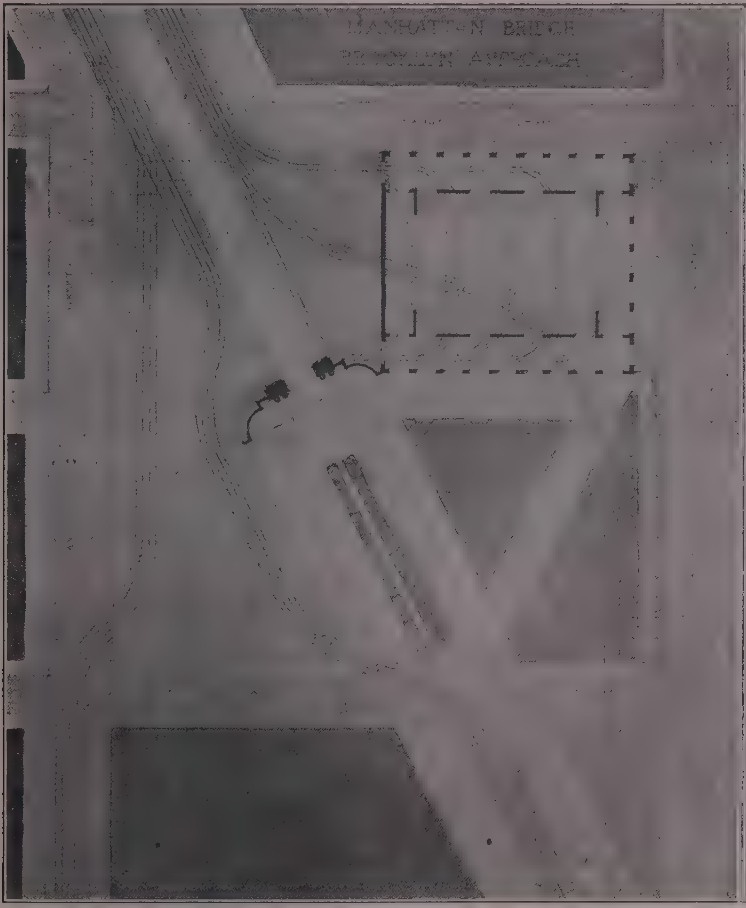
AMERICAN NAVAL STATION IN THE PHILIPPINES.

The United States government has decided to maintain a naval base in the Philippines, and work will shortly be started on it by J. G. White & Co., of New York City, who have been awarded a contract for the construction of a completely equipped naval coaling station, at Alongapo, on Subig Bay, P. I. The present installation will constitute one of six units which will ultimately be built, providing a coal storage of 120 tons for the use of the U. S. navy. The initial unit will cost approximately $500,000 and will require 2 years to complete. Subig Bay, about 75 miles north of Manila, is one of the finest harbors in the East. It was originally intended to establish a naval base at Cavite, but the Board of Army and Navy Officers decided in favor of Subig Bay in preference to both Cavite and Guam. The harbor will be heavily fortified and it is estimated that it will require an expenditure of between $10,000,000 and $15,000,000 to carry out the work now proposed. A large part of the bay will be dredged to a depth of 35 ft., this being sufficient for the largest battleship in the navy.

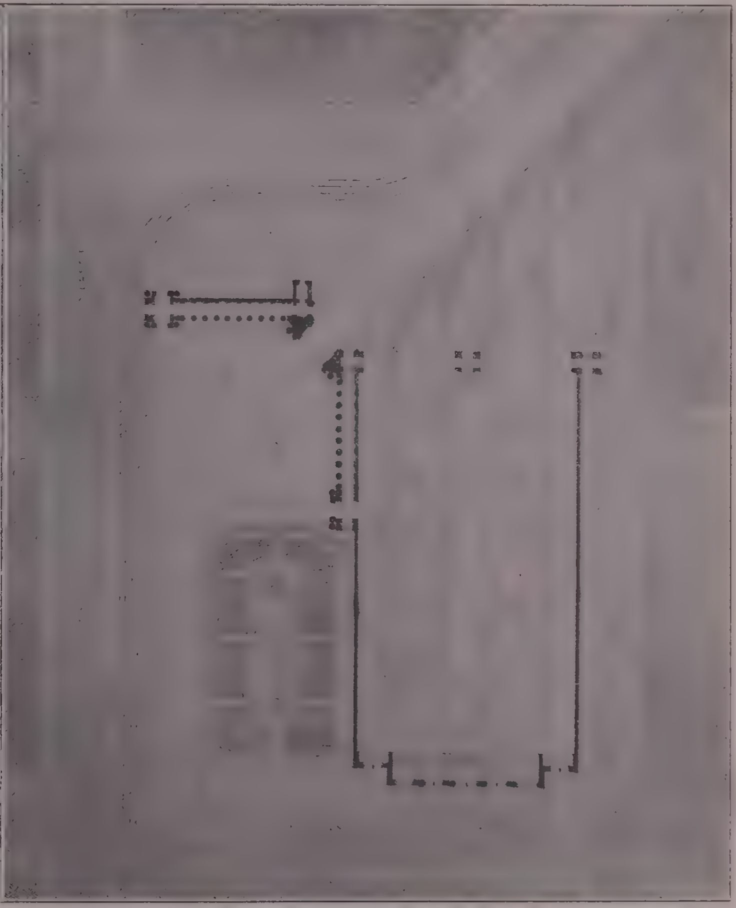
The coaling plant will consist of apparatus for unloading coal from vessels or cars, and storing same, together with means for reclaiming the coal from storage and delivering it to vessels or cars again. A 50,000-gal. water tank will be located on top of a nearby hill and a pumping plant provided, to supply it with water from the Benictigan River, about 1.5 miles from the station. This water will be used for the fire, protection of the coaling station, and to supply vessels.

The coaling unit about to be installed will be built upon a wharf 250 ft. long and 275 ft. wide. This wharf will be set upon clusters of piles which will be enclosed in concrete in order to protect them from the action of the teredo. The dock of the wharf is of steel and concrete. From the outer edge of the wharf a steel and concrete coal bunker will be erected, having a capacity of 5 tons of coal per running foot. It will be provided with chutes for delivering coal upon the deck of vessels or into cars. An electrically operated movable coal unloading tower, constructed of steel, will be operated on a track extending along the top of the coal bunker. It is designed for taking coal over from cars on the landward side of the wharf, or from colliers on the seaward side, and delivering this coal either into the bunker or upon a conveyor which will carry it to the coal storage building. The conveyors will have a capacity of from 100 to 150 tons of coal per hour. The coal storage shed will be a 150 x 450-ft. steel structure with a concrete floor, and will hold approximately 15,000 tons. The enclosure will be divided by concrete partition walls, so that the greatest amount of coal in one pocket will be 600 tons, thus preventing the spread of fire. Electric thermostats will be located at 20-ft. intervals, and will ring an alarm in the office of the superinteddent should the temperature of the coal rise above a fixed point. All of the conveyors and other apparatus for handling the coal will be electrically operated, and a power house of ample capacity will be installed adjacent to the coal storage building.

The unit to be erected immediately will be supplemented from time to time by other units of similar size and type, the wharves extending continuously along the bay front. Each wharf will accommodate a battleship, which can be supplied with 2,000 tons of coal in less than half a day. All of the coal used will be brought from the Virginia coal fields in tramp steamers, via Suez, at a cost practically of $8.00 a ton at Subig Bay, as against $5.00 for Japanese coal and $5.50 for Australian coal. It is, however, of a considerably higher grade and better adapted for use under the marine boilers than those coals. In conjunction with the coal station, extensive marine and repair shops will be built, in which repairs of any kind can be carried out, and small cruisers and gunboats entirely constructed. Large floating docks will also be built to accommodate the largest vessels in the American navy.



TRACK ARRANGEMENT, BROOKLYN TERMINAL.



TRACK ARRANGEMENT, MANHATTAN TERMINAL.

TRIALS OF GAS ENGINES WORKED FROM SUCTION GAS-PRODUCERS.

At the annual show of the Highland and Agricultural Society of Scotland, held in Glasgow last summer, there were some trials of suction gas-producer plants; and the results have now been published by the Society. The report is signed by Jonathan Middleton, Steward, and R. Stanfield, M. Inst. C. E., Engineer. The chief object which the directors had in view in conducting the trials, it is said, was to afford members of the Society an opportunity of becoming better acquainted with the combination of the suction gas-producer and gas-engine as a cheap and convenient source of power, and at the same time to demonstrate that the suction gas-producer is a practical and simple appliance. The following abstract of the report is reprinted from the Journal of “Gas Lighting” of London:

The Society provided space in the showyard, free of charge, to exhibitors submitting plants for trial. No awards were made; and the trials were arranged so as to test the plants as nearly as possible under their ordinary working conditions. It was suggested to intending exhibitors that each firm should submit for trial two complete plants, consisting, in each case, of gas-producer, scrubber, etc., and gas-engine of suitable power. The plants were to be of the capacities of from 15 to 20 brake-horse-power at full working load, and of 5 to 18 brake-horse-power. No restriction whatever was imposed on exhibitors in regard to the size and capacity of the generators. Ten complete plants, exhibited by six firms, were submitted for trial. These were the “Acme,” the “Campbell,” the “Crossley,” the “National,” the “Tangye,” and the Industrial Engineering Company. All the engines, with one exception, were fitted with indicator gear, and provided with revolution and explosion counters. The indicators used throughout the trials were of the “McInnes-Dobbie” external spring gas-engine type, by Messrs. Dobbie, McInnes, Limited, of Glasgow. The diagrams obtained were uniformly good and reliable, and showed an entire freedom from vibration.

At the conclusion of the trials the indicators were carefully examined, and were found to be in perfect condition—the pistons moving freely, and the parallel motions being without shake at any of the points. Scotch anthracite “peas,” from Gartshore Colliery, were used throughout the trials. This coal cost 9s. 3d. per ton delivered in the showyard. It was of good quality; and none of the plants appeared to experience any difficulty in using it satisfactorily. Previous to the commencement of each trial, the producers were charged with sufficient coal (which was not weighed) to bring them up to their proper working condition, and the plants were required to be ready and working steadily for 30 minutes before the time of starting the trials. In each of the power tests, the time of starting was taken when the producer was filled with fuel to a predetermined level; the ashes and clinker, as far as possible, having been previously cleaned out, and the engine working steadily at the stated load. At the end of the test, the producer was brought as nearly as it was possible to judge to the same condition as to fuel, etc., as at the start, and the fuel consumption determined from the amount introduced into the producer during this period.

At the beginning and end of each test, the mass of fuel in each producer was consolidated as much as possible by working it from the top with a poker, in order to break down any arches that might have formed in the lower part of the producer. It is a well-known fact in connection with the suction gas-producers, that after a few hours' run, clinker forms in the generator; and unless broken down by bars from the outside, it is apt to cause a hollow space in the fuel bed. Great care was exercised in removing the ashes, and any clinker from the back of the fire, so as to prevent the main body of fuel in the producer from coming down. In the producers which were provided with two or more doors on the grate level, this difficulty was not so serious. Some designers of suction plants hold that the anthracite in the lower part of the producer should be disturbed as little as possible; but with a low-class quality of fuel, liable to clinker, it is obvious that some adequate provision should be made for readily removing the clinker, etc. Each plant was required to undergo a full and a half-power trial of not less than ten hours' duration; also a light-load trial for a period of five hours. It was stipulated that not more than two men would be allowed to look after and attend to each plant—producer and engine.

By making the duration of each power trial ten hours, it was considered that any error in arriving at an estimate of the fuel consumption would be minimized. At the same time, in view of the very small amount of coal used in the majority of the plants, it was necessary to draw attention to the fact that the fuel consumption obtained might be slightly under the true value, though the degree of error could not be large. In the light-load test the coal sonsumption was not measured, as the object was rather to ascertain the capabilities of the producers to supply gas to the engines when running without any load. All the plants that were tested completed the light-load test satisfactorily. If they desired, exhibitors were allowed to remove any ashes or clinker from the producers in the course of, and at the end of, the full and the half-load trials. This was done with all the producers except the Dowson, which were worked by the National Gas Engine Company, and which were not cleaned out till the close of the third test. At the end of the power and light-load trials all the producers were thoroughly emptied, and an examination made for clinker. It was originally intended to weigh the ashes and clinker; but, unfortunately, on account of an accident, this became impracticable. On the whole, it was considered that the total amount of clinker formed during the trials was practically the same in each plant. The quantity was very small, and did not seem to have any disadvantageous effect on the working of any of the plants.

ABSTRACT OF RESULTS OF TESTS OF SUCTION PRODUCER PLANTS.

	Campbell Gas Engine Co.	Crossley Bros.	National Gas Engine Co.	Tangyes L't'd.
Full Load—				
Brake-horse-power	20.44	15.35	20.57	19.98
Indicated horse-power....	23.73	18.25	25.54	23.45
Mechanical efficiency, p. ct.	86,10	84.10	80.60	85.30
Total coal used, lbs.......	190.00	96.50	165.75	166.00
Coal per B.H.P. per hr., lbs.	0.93	0.77	0.80	0.83
Half-Load Trials.				
Brake-horse-power	10.69	9.06	10.48	10.72
Indicated horse-power	15.12	13.00	14.76	14.59
Mechanical efficiency, p. ct.	70.70	69.70	71.00	73.50
Total coal used, lbs......	98.00	87.25	100.25	116.00
Coal per B.H.P. per hr., lbs.	0.92	0.96	0.95	0.92

	Campbell Gas Engine Co.	Industrial Engr. Co.	National Gas Engine Co.	Tangyes, L't'd.
Full-Load Trial—				
Brake-horse-power	8.25	9.72	9.74	8.34
Indicated horse-power....	9.66	...	11.88	10.86
Mechanical efficiency, p. ct.	85.40	...	82.00	76.80
Total cost used, lbs.......	100.75	110.25	82.00	100.50
Coal per B.H.P. per hr., lbs.	1.22	1.13	0.84	1.25
Full-Load Trial—				
Brake-horse-power	4.43	4.36	5.36	4.57
Indicated horse-power	6.41	...	6.97	7.49
Mechanical efficiency, p. ct.	99.10	...	76.80	61.00
Total coal used, lbs......	41.50	56.75	49.00	67.50
Coal per B.H.P. per hr., lbs.	0.94	1.55	0.91	1.48

After the producers had been emptied and allowed to cool, a further test was made to ascertain the length of time required to get up to full working load, starting with the producer empty and cold. The time occupied was taken from the moment of inserting the firewood until the engine was carrying the same load as during the full-power trial; and this load it was required to sustain for twenty minutes. The average time necessary for the test seemed to be about fifteen minutes. With a few trifling exceptions, none of the plants experienced any real difficulty in running for the specified period of ten hours—in fact, there was no doubt that they could easily have worked quite well for a much longer time. The amount of attention which these plants required was remarkably small; very little labor being necessary for cleaning and stoking. Working under ordinary conditions—not a test—it was not considered that it would have been necessary to clear out the ashes and clinker, except, perhaps, at the end of each day's run. This, in any case, was a simple operation, which could be performed in a few minutes, and did not require the presence of a special attendant.

On the whole, the results of the trials were most satisfactory; and the economy, efficiency, and simplicity of working of the suction gas-producer plant was demonstrated beyond question. On the combined trials at full and half-load (twenty hours altogether), the average coal consumption for all the plants was about 1 lb. of coal per brake-horse-power per hour; costing about 1/20d.—coal at 9s. 3d. per ton. This was a remarkable result. It meant that an engine developing 20 brake-horse-power could be run at a cost of about 1d. per hour. Considering the manifest difficulties in arriving at strictly accurate results, no attempt had been made to place the various plants in any order of merit. For the combined trials, the coal consumption for the large engines was practically the same for all the plants. The greatest variation was to be seen in the coal consumption of the small plants—0.87 lb. to 1.30 lbs. per brake-horse-power per hour. This was to be expected.

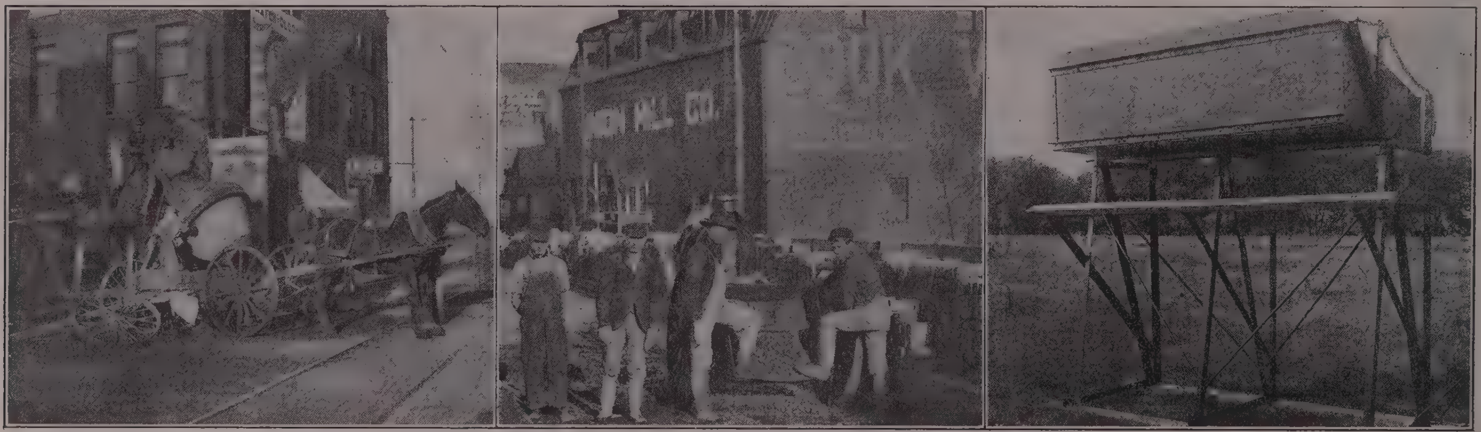
It would be unjust to draw any invidious distinction between the various plants. Without exception they were simple in construction, and every detail, both in engine and gas-producing plant, had evidently been carefully considered with a view to giving the best results. The committee felt that they had performed the task which they undertook—viz., demonstrating publicly the economy and the workability of the suction gas-producer plant. Tables of the results are given, from which the figures in the accompanying abstract were prepared.

NEW EQUIPMENT FOR CONTRACTORS' USE.

During the past season the Barber Asphalt Paving Co. laid about 80,000 sq. yd. of asphalt pavement in Waterloo, Ia., and employed several new types of equipment in this work. One of these was an unloading hopper intended to save money in unloading cars. It is generally the case where a shipment of broken stone is received, that the men at the cars work only a part of the time, being idle when there are no wagons to receive the stone. The unloading hopper is intended to avoid this idling It is a steel box, the size being selected to conform with the capacity of the carts; 1½, 2 and 2½-yd. boxes are regularly made, but the smallest is generally the most useful. One side of the box is an apron, hinged at the bottom and held by a latch, and the whole box is mounted on an axle. The apparatus is supported on a light steel frame resting on oak sills and can be moved along the side of the car, to suit the convenience of the men unloading it. When a wagon drives up alongside the hopper, it is unlatched, allowing the apron to fall and the box to tip over, emptying its contents into the wagon. The saving in labor charges effected by three of these machines on the Waterloo paving work is stated by the superintendent to have saved much more than their cost on this single season's contract.

The concrete was taken from the mixers in three concrete spreaders, each mounted on a pair of wheels and hauled by a single horse. This cart has a box holding about two-thirds of a yard, and ending at the bottom in a V-shaped hopper. This hopper has a gate which can be opened a variable amount, to be adjusted to conform with the thickness of the bed for which the concrete is used. The spreader is backed under the platform of the mixer, as shown in one of the illustrations, and a batch of concrete dumped into it. By using rather slow-setting cement the material can be hauled a considerable distance before it begins to set, and it is deposited in place by opening the hopper gate at the proper amount, very little labor being required in spreading. There is no necessity with this cart of tipping the body, as shown in the middle picture, which throws the concrete on the roadbed in a heap, requiring considerable labor in spreading According to the Waterloo experience, these spreaders "cut down the cost of laying concrete over 2 cents a square yard and produced a better job by delivering the soft part of the mixture on top to fill up all voids, making it easy and quick to level off." This quotation is from a letter by the superintendent of the work.

Another type of cart used on this work was also a spreader, although of much larger capacity. It had a body of steel with an asbestos board lining, and held ½ cu. yd. Two pairs of wheels were, of course, necessary. This box is 4 in. wider at the rear than in the front, and is so hung on an axle that there is about 150 lb. unbalanced pressure tending to drop the rear end, when loaded. When the latch is sprung, the body tilts downward, the rear apron opens an adjustable amount, fixed in accordance with the thickness it is desired to have the material assume, and the contents slide out smoothly. Experienced drivers do not stop their teams at all in delivering the loads, and as the bottom of the box does not strike the ground when it is dumped, it is not exposed to injury. Fifteen of these carts employed on the Waterloo work were strongly approved by the contractors, and an Omaha contractor using them for hauling brick has expressed equally strong approval.



CONCRETE CARTS AND UNLOADING HOPPER USED BY PAVEMENT CONTRACTORS IN WATERLOO.

This equipment was all designed by Mr. J. E. Briggs, of Waterloo, Ia., and is now being sold by the J. E. Briggs Labor Saving Specialty Co. of that city.

BUSINESS NOTES.

The Hendrick Mfg. Co., of Carbondale, manufacturers of perforated metals and general sheet iron works, have recently placed Mr. Byram C. Guerin in charge of their New York office at No. 149 Broadway. Mr. Guerin has for the past two years been connected with the firm of Clendenin Bros., of Baltimore, Md., importers and jobbers of metals, widely known to the trade.

Shop heating and ventilating plants have recently been ordered from the B. F. Sturtevant Co. by the Aetna Cotton Mills, Union, S. C.; the Pennsylvania R. R. Co. for buildings at South Altoona and Enola, Pa.; H. S. Kerbaugh, Inc., Altoona, Pa.; Page Woven Wire Fence Co., Monessen, Pa.; Detroit Oak Belting Co., Detroit, Mich.; Boyne City Tanning Co., Boyne City, Mich.; the Ancram Paper Mills, Ancram, N. Y.

The Jeffrey Manufacturing Co., of Columbus, Ohio, have recently established a New England branch with offices in the Oliver Building at 141 Milk St., Boston. Mr. H. C. Freeman, for many years with the home office at Columbus, is the engineer in charge. Catalogues, prices and specifications covering the Jeffrey complete line, can be had by addressing this office.

The Bury Compressor Co., of Erie, Pa., report business unusually brisk. Among recent orders they mention the following: Ball Engine Co., Erie, Pa., 250-ft. machine; Parish & Bingham Co., Cleveland, O.; 135-ft. machine; Erie City Iron Wks., Erie, Pa., air end of 1,670-ft. machine; American Steel & Wire Co., Cleveland, O., 857-ft. machine; E. W. Bliss Co., Brooklyn, N. Y., 350-ft. machine; Edw. E. Rieck Co., Pittsburg, Pa., 450-ft machine; Macbeth Evans Glass Co., Elwood, Ind., plant, 835-

ft. machine; Morgan Engineering Co., Alliance, O., 350-ft. machine. Foreign business also keeps up, among one of their recent orders being one for Japan of 135-ft. capacity.

In reference to the article on the "Sewage Pumping Station at the Hampton Institute," in the Engineering Record of Nov. 18, the Cummings Structural Concrete Co. corrects the statement as to the design of the reinforced concrete tanks and stack. All of this reinforced concrete work was designed and constructed by Mr. Robert A. Cummings, M. Am. Soc. C.E., consulting engineer of the company.

There is no diminution in the demand for machinery to equip plants for making hollow concrete building blocks. On a recent trip, H. S. Palmer, of the Harmon S. Palmer Hollow Concrete Building Block Co., of Washington, D. C., sold exclusive rights to his system in Lackawanna County, Pa., and three machines; one of the purchasers being A. T. Troutwine of the Carbondale Machine Works. He also sold rights to Camden County, N. J., and two machines to George A. Aldrich, of Philadelphia.

Toch Brothers, New York, announce that hereafter the offices and salesroom of their business will be located at 320 Fifth Ave., corner of 32d St., Rooms 709-711-713.

The Whitehead & Kales Iron Works has been incorporated with a capital of $100,000, of which amount $1,479.70 is represented by cash and the remainder $98,520.30 is represented by real estate, machinery and merchandise of the Whitehead & Kales plant, located at the corner of Beecher Ave. and M. C. R. R., Detroit, Mich. James T. Whitehead and Wm. R. Kales hold 4,500 shares each, and James T. Warner and Wm. H. Steger 500 shares each. The officers are, as follows: James T. Whitehead, president and treasurer; Wm. R. Kales, vice-president and engineer; James T. Warner, secretary; Wm. H. Steger, superintendent.

The new shops at Eddystone of the Belmont Iron Works, of Philadelphia, are now in successful operation, and can handle structural material for bridges and buildings of all kinds up to 25-ton pieces. The company will also carry a large stock of plates and shapes so as to be in position to make prompt deliveries. The Eddystone plant has a capacity of over 1,000 tons of structural steel per month, and the Philadelphia shops, which will be kept in operation, have as much more.

PERSONAL NOTES.

Mr. H. H. Henshaw has resigned as general manager of the Allis-Chalmers-Bullock Co., of Canada.

Captain Clarke S. Smith, Corps of Engineers, U. S. A., has been transferred to Washington Barracks.

Mr. Frederick K. Betts, of Katonah, N. Y., has been appointed assistant engineer of the Board of Water Supply of New York City.

Dr. J. B. Porter read a paper on "Testing of Explosives Used in Engineering," Nov. 30, before the mining section of the Canadian Society of Civil Engineers.

Mr. C. S. Powell, general agent of the Westinghouse Electric & Mfg. Co., has moved the offices of that company in New York City to the Trinity Building.

Mr. H. W. Baker, assistant engineer on Chicago & Northwestern R. R., has been appointed professor of civil engineering in the University of Nevada.

Mr. D. E. Meyerly has been appointed superintendent of the Sigourney, Ia., water works, succeeding Mr. George Covey.

Mr. H. K. Bishop has resigned as chief engineer of the special commission of public works, of Hudson, N. Y., and become connected with Mr. C. C. Vermeule, of New York City.

Mr. James B. Oliver, president of the Oliver Steel & Iron Co., died at his home in Shields, Pa., Nov. 28. Mr. Oliver was also president of the Oliver & Snyder Steel Co., and the Monongahela Natural Gas Co.

Mr. W. S. Dawley, engineer of maintenance of way of the Chicago & Eastern Illinois R. R., has been appointed chief engineer, and will be succeeded by Mr. R. H. Howard.

Mr. John C. Wait, of New York City, delivered an address at the Clarkson Memorial School of Technology, Nov. 30, the occasion being the tenth anniversary of the founding of the institution.

Mr. G. B. Mitchell, assistant chief engineer of the Canadian Pacific R. R., has been appointed superintendent of building construction for the New York, New Haven & Hartford R. R., with headquarters in New York City.

Mr. Judson C. Dickermann, formerly superintendent of the Merrimac Chemical Co., of Boston, has been appointed assistant professor of chemical engineering in the college of engineering of the University of Wisconsin. Mr. Dickerman is a graduate of the Massachusetts Institute of Technology.

The nominating committee of the Engineers' Society of Western Pennsylvania presented the following names at the last regular meeting: Julian Kennedy, for president; J. K. Lyons, for vice-president; F. V. McMullin, for secretary; A. E. Frost, for treasurer, and E. K. Morse and A. R. Raymer for directors.

Mr. J. A. Smith, president of the Pacific Coast Construction Co., died recently in Hazen, Nev. Mr. Smith's company had a contract for building a portion of the Western Pacific R. R., which has been taken over since his death by Messrs. E. B. and A. L. Stone, of Oakland, Cal.

The Washington, D. C., Society of Engineers was formed at a recent meeting attended by about 125 local engineers from all branches of the profession. Admiral C. W. Rae, engineer in chief, U. S. N.; Major John Biddle, engineer commissioner of the District of Columbia; H. M. Wilson, C. W. Hayes, W. A. McFarland and L. D. Bliss were designated as a temporary committee to draft a constitution.

Mr. Louis L. Smith, of Haverhill, Mass., has been appointed master mechanic of the Schenectady, N. Y., Railway Co., succeeding Mr. John G. Baukat, who has resigned. Mr. Jones graduated from Cornell University with the class of 1890, receiving a degree in both mechanical and electrical engineering. After graduating he became division master mechanic and general shop foreman of the Chicago, Burlington & Quincy R. R., at Aurora, Ill. He is at present master mechanic of the New England Railway at Haverhill, Mass.

Mr. William S. Manning, superintendent of the Essex County, N. J., Park Commission, has been appointed superintendent of parks in Baltimore, Md. Mr. Manning has held his present position six years. Prior to that time he had charge of laying out the country seat of H. McKay Twombly, near Madison, N. J. For fifteen years previous to his connection with that work he was asociated with the late Frederick Law Olmsted, in laying out the estate of George W. Vanderbilt, at Biltmore, N. C.; the country house of John D. Rockefeller, at Tarrytown, N. Y.; the grounds of the Columbian Exposition and the public park system of Boston.

TRADE PUBLICATIONS.

Bulletin 409 of the Stanley-G. I. Electric Mfg. Co., Pittsfield, Mass., is devoted to switchboards for small direct-current plants of 5 to 20 kw. at 125 volts, or 10 to 40 kw. at 250 volts. This line has been designed for use in isolated plants with a single generator and from one to six feeder circuits. All panels for one to four feeders are made of the same size to give room for attaching additional feeders; the fifth and sixth feeder switches are mounted on a separate slab directly below the panel. Each panel is a complete switchboard in itself and is not designed to be used in connection with other panels.

One of the most popular pamphlets ever issued by a cement company is that on cement sidewalk paving prepared by Mr. Albert Moyer, general sales agent of the Vulcanite Portland Cement Co., Philadelphia and New York. The third edition has just been prepared and contains suggestions for various types of sidewalk, curb and gutter, well worth the careful attention of engineers and contractors.

The Electric Water Purifying & Filter Co., 25 Broad St., New York, has issued a pamphlet describing in outline its method of softening and purifying water. It is stated to liberate a large amount of free oxygen, which is the active agent in producing the desired results.

There are many manufacturing companies sending out circulars and similar trade literature at frequent intervals, which find that the labor of addressing the envelopes for this purpose is unexpectedly expensive. A pamphlet issued by the Rapid Addressing Machine Co., 290 Broadway, New York, describes a machine which does such work very rapidly and clearly by means of stencils, cut on a type-writer.

The channeling machine is one of the most ingenious applications of the percussion rock drill, and has effected great savings in quarry operations as well as in excavating rock under certain special conditions, as alongside buildings. The Ingersoll-Sergeant Drill Co., 11 Broadway, New York, built the first of these machines about twenty years ago, and has since made it a favorite specialty. The new catalogue issued by the company concerning these channelers is a handsome book of 48 pages, describing their usefulness, capabilities and construction. The book is more than a trade catalogue; it is a manual of quarrying operations with such apparatus.

An unusually concise and good explanation of the advantages of mechanical draft is given in a booklet prepared by the B. F. Sturtevant Co., Hyde Park, Mass. The general statements concerning forced and induced draft are supplemented by brief illustrated descriptions of eight typical installations.

The new publications of the Publication Bureau of the General Electric Co., Schenectady, N. Y., are as follows: Flyer 2,167, plug cut-outs for 125 and 250 volt circuits; flyer 2,168; incandescent lamp socket for outdoor deco-4,422, portable substations for electric railways; cataration bulletin 4,421, the Ge-80 railway motor; bulletin logue 3,366, Edison lamps; catalogue 9,137-2, list of Curtis steam turbine plants. In connection with the last catalogue it may be stated that although the first of these turbines was put in commercial service only a little more than three years ago, the rated capacity of the installations now running is over 135,000 kw.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

**Woodland, Cal.*—P. N. Ashley, City Surveyor, writes that Dyer Bros., of San Francisco, have secured the contract for a tank and tower (bids opened Nov. 20) for $5,225.

Santa Monica, Cal.—The Special Com. is stated to have reported in favor of municipal ownership of the water works, and the City Engineer is reported to have been instructed to prepare an estimate on the cost of water works.

San Diego, Cal.—B. M. Warner, of San Diego, Gen. Supt. Southern California Mountain Water Co., writes that it is proposed to construct about 17 miles of pipe, reservoir, etc., at a cost of $400,000. Bids will be received for this work until about Dec. 20. Engineer, Andrew Ernst.

Washington, D. C.—Bids will be received by the Comrs. D. C. until Dec. 30 for furnishing and erecting a vertical, triple expansion, crank and fly wheel condensing pumping engine, having a capacity of 30,000,000 gal. in 24 hours, as advertised in The Engineering Record.

Valdosta, Ga.—Bids are wanted for a duplex air compressor capable of delivering 850 to 1,000 cu. ft. of free air per minute; also an underwriter's fire pump, capable of delivering not less than 1,000 gals. of water per minute. A. W. Varnedoe, City Clk.

**Milledgeville, Ga.*—T. H. De Saussure, Engr. Georgia State Sanitarium, writes that the contract for constructing water works and filtration plant at the Sanitarium (bids opened Nov. 15) has been awarded as a whole to Walton & Wagner, of Rome, for $65,000.

Minooka, Ill.—M. L. Kaffer, Village Clk., writes that bids will probably soon be called for again for the construction of the proposed water works.

Oak Park, Ill.—The citizens are reported to be discussing the question of purchasing the water works of the Chicago Suburban Water & Light Co. The company proposes to lay a 24-in. pipe from Austin Ave. to Oak Park; also install electric engines before turning system over to town.

Chickasha, Ind. Ter.—The City Council is reported to have taken preliminary steps for expending $50,000 on water works and sewerage extensions.

Muskogee, Ind. Ter.—Bids will be received by W. W. Momyer, City Recorder, until Dec. 21, for constructing about 10 miles of sanitary and storm sewers, and 6 miles of water mains, as advertised in The Engineering Record.

Albia, Ia.—The City Council is reported to have decided to construct water works to cost about $45,000.

**Ft. Williams, Me.*—The contract for extending water and sewer lines at Ft. Williams has been awarded to F. H. Marshall, of South Portland. (Bids for this work were opened on Nov. 11 by Capt. A. W. Yates, Q. M., U. S. A., Portland.)

Baltimore, Md.—A resolution has passed both branches of City Council, appropriating $40,000 of the Western Maryland fund, to improve water mains and appliances in the burnt district.

Spencer, Mass.—Nathan E. Craig is stated to have about completed his report, looking to an increase of the water supply and will recommend taking a large water shed at Shaw pond.

Chicopee, Mass.—The City Water Dept. is reported to be considering the question of supplying Fairview with water; it will be necessary to lay about a mile of 6-in pipe.

Pittsfield, Mass.—Engineers are reported to have completed surveys preliminaary to increasing the water supply of the city. A site has been selected for the purposed reservoir, which, it is stated, will have a storage capacity of about 250,000,000 gals. A. A. Fobes, City Engr.

Springfield, Mass.—Allen Hazen, of New York, N. Y., submitted to City Council on Nov. 20th a report on an intermittent sand filter, four acres in extent, to filter Ludlow reservoir water during the anabaena season every summer. The City Council approved the plans and appropriated money the same evening; total cost of work about $75,000. Preliminary grading contract, 30,000 cu. yds., let to F. T. Ley & Co., Springfield, work to be completed March 1, at 29¾ cts. per cubic yd. E. E. Lochridge, Engr. Water Dept.

**Detroit, Mich.*—The contract for constructing new smokestack at the pumping station is reported to have been awarded to Wm. M. Blay, for $10,490.

Muskegon Heights, Mich.—Herbert Pedler, Secy. Water Com., writes that the Council expects to issue $45,000 bonds in January for the construction of water works.

Duluth, Minn.—Probably during the coming year a new pump will be installed at the Lakewood pumping station, at a cost of about $30,000. L. N. Case, Engr. of the Water and Light Dept., will have charge of the work. H. W. Cheadle, City Clk.

**Perham, Minn.*—The following are reported to be the bids recently received for laying water mains: W. I. Gray & Co., Minneapolis, $5,220; O. F. Doyle, St. Cloud, $5,000; Dwyer & Co., St. Paul, $5,000, and Pastoret & Lunz, Two Harbors, $4,921 (awarded contract).

Sleepy Eye, Minn.—J. F. Johnson, of Gibbon, is reported to have prepared plans for an extension of the water works.

Savannah, Mo.—L. M. Booker, City Clk., writes that Burns & McDonnell, Dwight Bldg., Kansas City, are engineers for the proposed water works, to cost about $34,000.

Bordentown, N. J.—The Common Council is reported to have authorized the Water Comn. to issue $15,000 bonds for the completion of the new water plant.

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* *Items marked thus give the names of parties awarded contracts.*

**Asbury Park, N. J.*—John L. Coffin, Supt. Dept. Water & Sewers, writes that the contract for a 200-hp. internal furnace tubular boiler (bids opened Nov. 27) has been awarded to David C. Seymour, of Newark, for $2,930.

Long Island City, L. I., N. Y.—Bids will be received until Dec. 13 by John T. Oakley, Comr. Water Supply, Gas and Electricity, New York City, for furnishing, delivering and laying water mains in numerous streets; also furnishing, delivering and setting 21 fire hydrants, all in College Point; bids will also be received same date for furnishing, delivering and laying water mains in 4 streets, Bayside, Boro. Queens.

Brooklyn, N. Y.—Bids will be received until Dec. 13 by John T. Oakley, Comr. Water Supply, Gas and Electricity, New York City, for furnishing and delivering c.i. flanged pipe, special castings, etc.; also furnishing and erecting a wrought-iron fence, with gates, at the Mt. Prospect Reservoir, all in Boro. Brooklyn.

Seneca Falls, N. Y.—The question of establishing municipal water works is reported under consideration here.

Lockport, N. Y.—It is stated that an election will be held Dec. 19 to vote on two municipal water supply propositions now before the city, to have the Tonawanda Creek or Niagara River as the respective sources of supply. Either plant, it is estimated, would cost about $500,000.

Buffalo, N. Y.—Bids will be received until Dec. 6 by the Dept. Pub. Wks. (Francis G. Ward, Comr.) for tunnel under Buffalo River, near southerly end of Ohio St., in which to lay a water pipe for supplying property south of Buffalo River. Tunnel through rock, 6 ft. 6-in. drain; two shafts through rock, 7-ft. drain; length of tunnel, 324 ft. Bids on material and labor to be submitted separately.

New York, N. Y.—The Bd. of Estimate on Nov. 24 appropriated $500,000 to the Bd. of Water Supply to defray projected expenses.

Bids will be received until Dec. 13 by John T. Oakley, Comr. Water Supply, Gas and Electricity, for furnishing, delivering and laying water mains in several streets; also furnishing and delivering double-nozzle standard New York hydrants, lead-lined iron pipe, unions, elbows and couplings; excavating and removing rock in trenches, etc.

New York, N. Y.—Bids were opened on Nov. 22 by John T. Oakley, Comr. Water Supply, Gas and Electricity, for furnishing, delivering and laying high pressure fire service mains and appurtenances in the Southern, Northern and Middle districts: The following are the total of bids received which include valves, hydrants, etc., also unit prices on some of the items required: (*a*) Lynch Contr. Co., $3,700,443, (*b*) Frank Bradley, 86th St. and Bway., $3,571,365.

	a	*b*
30,700 tons straight cast-iron pipe	$40.00	$38.00
295 tons cast-iron specials, Class A	120.00	130.00
1,025 tons cast-iron specials, Class B	110.00	120.00
1,395 tons cast-iron specials, Class C	100.00	95.00
30 tons cast-steel specials, Class A	250.00	250.00
275 tons cast-steel specials, Class B	250.00	250.00
600 cast-iron castings	50.00	60.00
35,300 lin. ft. 24-in. pipe	1.40	1.35
30,000 lin. ft. 20-in. pipe	1.30	1.25
47,100 lin. ft. 16-in. pipe	1.25	1.20
156,500 lin. ft. 12-in. pipe	1.15	1.10
25,800 lin. ft. 8-in. pipe	1.05	1.00
950 lin. ft. 6-in. blow-off pipe	.50	.60
300 lin. ft. 36-in. low-pressure water pipe	1.50	1.45
300 lin. ft. 30-in. low-pressure water pipe	1.50	1.35
300 lin. ft. 24-in. low-pressure water pipe	1.30	1.25
300 lin. ft. 20-in. low-pressure water pipe	1.20	1.15
300 lin. ft. 16-in. low-pressure water pipe	1.15	1.10
2,000 lin. ft. 12-in. low-pressure water pipe	1.10	1.00
300 lin. ft. 8-in. low-pressure water pipe	1.00	.80
400 lin. ft. 6-in. low-pressure water pipe	.75	.60
165,000 lbs. wrought iron	.05	.06
503,000 lbs. of rolled steel	.05	.05
424,800 cu. yds. earth excav. and backfilling	1.80	1.65
700 cu. yds. rock excavation and backfilling	4.50	5.00
11,200 cu. yds. masonry excavation	3.00	5.00
600 cu. yds. brick masonry	18.00	15.00
4,700 cu. yds. concrete masonry	8.00	7.50
200 cu. yds. concrete masonry	8.00	8.00
4,550 sq. yds. asphalt pavement, including concrete base	4.00	4.50
58,650 sq. yds. asphalt pavement, including stone block base	4.00	3.75
55,550 sq. yds. granite block pavement, including concrete base	2.50	3.00
54,000 sq. yds. stone block pavement, including sand base	2.00	1.50
3,695 sq. yds. wooden block pavement, including concrete foundation	4.00	4.50
695 sq. yds. bluestone flag	2.00	2.70
300 sq. yds. bluestone flagging, including foundations	.50	1.50
4,500 lin. ft. stone curbing, including foundations	.15	.20
1,600 lin. ft. granolithic, including foundation	.40	.50
15 M. ft. lumber	60.00	50.00
10,700 lin. ft. 6-in. vitr. tile drain pipe	.40	.50

Ft. Buford, N. D.—Bids were opened on Nov. 15 at the office of the U. S. Reclamation Service, Glendive, Mont., for the construction of about 33 miles of main canal, and about 74 miles of branches and laterals, between Newton, Mont., and Buford, N. D., involving the excavation of 1,587,500 cu. yds. of material in the Ft. Buford project, N. D. and Mont. This work is divided into 16 sections: The following are the lowest bids according to the different divisions: Widell-Findley Co., of Mankato, Division 5, for $141,403; Div. 7 for $7,649; Div. 9 for $7,005; Laterals A and B, $3,880; Lateral C, $4,658; Laterals D and E, $7,713; Laterals F-a and G, $7,938; Laterals I, J, J-a and J-b, $5,378; Lateral K, $9,433; Lateral L, $4,978 and Lateral M, $4,818. Nels M. Olsen, of Butte, Div. 6 for $43,273. Lamb & Frye, of Glendive, Div. 8 for $5,439; Lateral F, $12,699; Laterals O and P, $6,237. Nohle & Mann, Buford, N. D., Lateral N, $5,727.

The detail bids on Divisions 5 and 6 are as follows: (*a*) Widdell, Findley Co., Mankato, Minn., (*b*) Nels M. Olsen, Butte, Mont.

Division 5.

	a	*b*
Excav., Class 1, 602,000 cu. yds.	$.169	$.175
Class 2, 120,000 cu. yds.	.30	.33
Class 3, 100 cu. yds.	.50	.50
Class 4, 10 cu. yds.	1.50	2.00
Overhaul, 140,000 cu. yds.	.015	.015
Puddling, 3,000 cu. yds.	.50	.75
Total	$141,403	$149,370

Division 6.

Excav., Class 1, 272,000 cu. yds.	$.168	$.149
Class 2, 100 cu. yds.	.30	.50
Class 3, 100 cu. yds.	.50	.50
Class 4, 10 cu. yds.	1.50	2.00
Overhaul, 75,000 cu. yds.	.015	.015
Puddling, 2,000 cu. yds.	.50	.75
Total	$447,916	$43,273

Lakewood, O.—Bids will be received until Dec. 9 by the Bd. Trus. of Pub. Affairs, H. W. Burton, Clk., for laying water mains in Webb Road.

Cleveland, O.—Bids will be received by the Bd. of Public Service until Dec. 18 for the construction, delivery and erection of two million gal. pumping engines, as advertised in The Engineering Record.

McMinnville, Ore.—See "Power Plants, Gas and Electricity."

Philadelphia, Pa.—Bids will probably soon be received by the Bureau of Filtration (Maj. C. E. Gillette, Ch. Engr.) for the temporary low service pumps to be constructed at the Torresdale filtration plant; they will have a capacity of 40,000,000 gals.

**Lebanon, Pa.*—Bolton G. Coons, of Wilkesbarre, is reported to have secured the contract to construct a reservoir and pipe line for the West Lebanon water supply for $15,927 (bids opened Nov. 16).

Pawtucket, R. I.—At a meeting of City Council on Nov. 22 the joint standing committee on water offered the report of Percy M. Blake, and recommended the adoption and the passage of a resolution of $300,000 for making the additions to the pumping plant as outlined. Geo. A. Carpenter, City Engr.

Bristol, Tenn.—The Bd. of Mayor and Aldermen is reported to have passed a resolution, repealing the ordinance authorizing the purchase of the Bristol-Goodson Water Co.

South Pittsburg, Tenn.—See "Power Plants, Gas and Electricity."

Dallas, Tex.—The City Council is reported to have under consideration the question of purchasing a large service pump for the Turtle Creek pumping station.

Salt Lake City, Utah.—Bids will be opened on Dec. 7, not Dec. 10 as previously stated, by the Bd. Pub. Wks. (C. A. Wall, Chmn.) for constructing a brick and concrete conduit to replace a portion of the Jordan and Salt Lake City Canal. Approximate quantities of work to be done are as follows: 2,000 cu. yds. excav. and backfill; removing wooden flume, 2,400 lin. ft.; 2,000 lin. ft. brick conduit; 1,000 lin. ft. concrete conduit; 1,000 lin. ft. 8-in. pipe and 6 manholes.

Ogden, Utah.—R. S. Campbell, of Salt Lake City, Gen. Mgr. Utah Light & Ry. Co., writes that it is proposed to construct a storage reservoir, at a cost of $300,000.

Richmond, Va.—Bids will be received until Dec. 14 by Chas. E. Bolling, Supt. of Water Wks., for furnishing sluice gates, guides, lifting stems and standards, floats and all parts and materials necessary for their erection complete for the different openings in the walls of the subsiding and coagulating basins.

Shenandoah, Va.—See "Power Plants, Gas and Electricity."

Vancouver Barracks, Wash.—The two lowest bids opened on Nov. 22 by the Constr. Q. M., U. S. A. (C. E. Earl, Clk.) for extension to the water supply, were submitted by Larney & Kiggins, of Vancouver, for $3,921, and the International Contract Co., of Seattle, at $3,988.

Pasco, Wash.—See "Power Plants, Gas and Electricity."

Port Angeles, Wash.—H. C. Heerman, of Olympia, is reported to have petitioned for a franchise to install water works and a pumping plant.

Manitowoc, Wis.—The City Council is reported to have instructed the City Engineer to prepare plans for municipal water works, to cost about $180,000.

Fredericton, N. B.—Bids will be received until Dec. 11 by J. W. McCready, City Clk., for $10,000 water bonds.

Chippewa, Ont.—The question of constructing water works is reported under consideration here.

San Juan, Porto Rico.—See "Power Plants, Gas and Electricity."

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Bisbee, Ariz.—C. W. Hicks, City Clk., writes that F. H. Olmsted, of Los Angeles, Cal., is preparing a report on the construction of a sewerage system, preliminary to the calling of a bond election.

**San Francisco, Cal.*—Healy-Tibbitts Constr. Co. is reported to have secured the contract for constructing sewers in Union, Baker, Broderick and Francisco Sts., for $47,605.

The Bd. of Pub. Wks. is reported to have decided to ask the Supervisors to set aside $10,000 to be used in the preparation of plans and specifications for the construction of sewers in the following districts: North Yerba Buena Dist., cost of construction, $240,000; South Yerba Buena Dist., to cost $155,000; Channel St. Dist., to cost $310,000, and West Harbor View Dist., cost $120,000.

Waterbury, Conn.—It is proposed to construct 2 miles of reinforced concrete outfall sewer 4 ft. 5 in. x 4 ft. 6 in. during 1906.

**East St. Louis, Ill.*—The Bd. of Highway Comrs. of Stites Township has awarded the contract for the improvement of the north side of St. Clair Ave. to the Hill-Gaynord Constr. Co., of East St. Louis, Ill. The improvement consists of laying 1,630 ft. of 18-in. pipe sewer, 1,675 ft. of limestone curb, and 2,000 sq. yds. of brick paving. The total prices were for Wabash brick, $6,319, and for Albian brick, $6,179. The engineering work will be in charge of W. J. Crocken, City Engr., of East St. Louis. Wm. West, Lovejoy, Ill., is Chmn. of the Bd. of Highway Comrs. of Stites Township.

Chicago, Ill.—Bids will be received until Dec. 5 by the Dept. Pub. Wks. (Jos. M. Patterson, Comr.) for furnishing material and constructing a c.-i. and steel plate engine pit at the Lawrence Ave. sewerage pumping station.

Michigan City, Ind.—See "Paving and Roadmaking."

Jeffersonville, Ind.—Victor W. Lyon, of Jeffersonville, is preparing plans for a 36-in. tile sewer about 1 mile in length.

Chickasha, Ind. Ter.—See "Water."

Muskogee, Ind. Ter.—See "Water."

Ft. Williams, Me.—See "Water."

**West Roxbury, Mass.*—McBride & Co., of Brighton, have secured the contract for building sewer in Walker St., West Roxbury (bids opened Nov. 28) for $3,736.

**Boston, Mass.*—Wm. J. Barry, 58 Kenwood Road, Roxbury, has secured the contract for building Section 5, of the Talbot Ave. High Level Sewer, Boston, for $14,312, and P. W. Hill, 141 W. Canton St., Boston, secured the contract for building Section 6 of the same sewer for $8,161.

Salem, Mass.—The lowest bid opened on Nov. 27 by the Sewerage Comrs. for a brick pumping station is stated to have been submitted by Pitman & Brown, of Salem. F. A. Hondlette & Son, 93 Broad St., Boston, are stated to have submitted the lowest bid for the c. i. pipe and special castings.

Delray, Mich.—The Village Council is reported to have decided to reject the only bid received on Nov. 15, which amounted to $24,860, for constructing sewers in the eastern part of city from Crawford to Louis Ave. and from River St. to the village limits. New bids will be received.

**Kansas City, Mo.*—N. H. Comstock is reported to have secured the contract for grading and sewer construction in Roanoke Road in Roanoke Park, for $6,120.

Norfolk, Neb.—Andrew Rosewater, of Omaha, Neb., is preparing plans for the proposed sewerage system, to cost $36,000. John Friday, Mayor.

McCook, Neb.—The City Council is reported to have decided to construct a sewerage system.

Paterson, N. J.—The Bd. of Aldermen on Nov. 27 passed a resolution to appropriate a sum of money not to exceed $10,000, for the purpose of employing an expert engineer to investigate the sewage disposal of Paterson.

Trenton, N. J.—Bids will be received until Dec. 5 by the Common Council for constructing a sewer in a portion of Gordon St.; also drains in Princeton, Southard and Hermitage Aves. Harry B. Salter, City Clk.

Gloversville, N. Y.—Sewer bonds amounting to $150,000 are reported sold.

Syracuse, N. Y.—Bids will be received until Dec. 11 (readvertisement) by the Bd. Contract and Supply, for furnishing material and constructing an 8-in. pipe sewer in Burdick and Murray Aves. Geo. J. Metz, City Clk.

Long Island City, L. I., N. Y.—Bids will be received until Dec. 12 by Jos. Cassidy, Pres. Boro. Queens, for constructing sewers and appurtenances in Webster Ave., Academy and Radde Sts. Engineer's estimate: 750 lin. ft. 24-in., 260 lin. ft. 18-in., 1,335 lin. ft. 15-in., and 1,745 lin. ft. 12-in. vitr. salt-glazed or cement concrete sewer pipe; 1,330 lin. ft. 16-in., 3,000 lin. ft. 6-in. vitr. salt-glazed or cement concrete sewer pipe as risers for house connections; 400 lin. ft. 12-in. vitr. salt-glazed or cement concrete culvert pipe; 6 M. ft. B. M. timber for found., furnished and laid; 25 M. ft. B. M. timber for bracing and sheet piling; 32 manholes; 17 receiving basins, complete, etc.

Brooklyn, N. Y.—Bids will be received until Dec. 13 by Martin W. Littleton, Pres. Boro. Brooklyn, for furnishing materials and constructing sewer in 15th Ave., from 60th to 66th St. The engineer submitted 2 estimates known as "A" and "B," and each requiring 245 lin. ft.

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* *Items marked thus give the names of parties awarded contracts.*

30-in. sewer; 84 lin. ft. 24-in. and 84 lin. ft. 16-in. c.-i. pipe sewer; 189 lin. ft. 24-in., 260 lin. ft. 18-in., 260 lin. ft. 15-in., and 541 lin. ft. 12-in. pipe sewer; 16 manholes; 7 sewer basins; 12 M. ft. B. M. found. planking; 205 cu. yds. concrete cradle; 25 M. ft. B. M. sheeting and bracing; 1 sewer basin reconnected; also furnishing material and constructing sewers in 60th St., from 2d to 3d Aves., and outlet sewers in 60th St., etc. The engineer submitted 3 estimates, "A," "B," and "C," each requiring 474 lin. ft. 30-in. sewer; 260 lin. ft. 24-in., 310 lin. ft. 18-in., 718 lin. ft. 15-in., and 762 lin. ft. 12-in. pipe sewer; 23 manholes; 8 sewer basins; 17 M. ft. B. M. found. planking; 185 cu. yds. concrete cradle under pipe sewers. Bids will also be received same time and place for constructing sewers in several streets. Engineer's estimate: 268 lin. ft. 24-in., 508 lin. ft. 15-in., and 2,875 lin. ft. 12-in. pipe sewer; 25,400 ft. B. M. found. planking; 80 M. ft. B. M. sheeting and bracing; 313 cu. yds. concrete cradle; 35 manholes; 13 sewer basins.

Cincinnati, O.—Bids will be received until Dec. 8 by the Bd.. Pub. Service (Geo. F. Holmes, Clk.) for furnishing material and constructing overflow sewers and drains in portions of Fairfield Ave. and Hackberry St.; also constructing sewers and drains in a portion of Clifton Ave., Charlotte St. and Keywill Alley; bids will also be received until Dec. 22 for constructing sewers in portions of Forest, Bogart and Glenwood Aves.

Cleveland, O.—Bids will be received until Dec. 12 by the Bd. Pub. Service (A. R. Callow, Secy.) for constructing sewers in portions of several streets.

Norwalk, O.—T. P. Kellogg, Clk. Bd. Pub. Service, writes that the plans of E. G. Bradbury, of Columbus, have been accepted for the proposed sewerage system.

Gloucester, Mass.—The State Bd. of Harbor & Land Comrs. is stated to have approved plans for the construction of a bridge at Western Ave.

Hyde Park, Mass.—The Selectmen on Nov. 22 were authorized to lay out a new bridge at Bridge St., of 2 arches, of concrete and granite faced 45 ft. 6 in. span. Action for building bridge depends on change of grade crossing plans by the Comrs., and future action of town; estimated cost $19,000.

Minneapolis, Minn.—Andrew Rinker, City Engr., writes that the following are the bids opened on Nov. 24 for the steel work necessary for widening Washington Ave. bridge: The Strobel Steel Constr. Co., $83,345; King Bridge Co., Cleveland, O., $60,000; St. Paul Foundry, St. Paul, $55,470; J. L. Brickles & Co., Sparta, Wis., $55,000; Canton Bridge Co., Canton, O., $53,780; Illinois Bridge Co., Chicago, $52,300; Hennepin Bridge Co., Minneapolis, $51,000; John Cilligan Co., Falls City, Neb., $50,989; Darst & Hayes, Chicago, $50,800; Clinton Bridge & Iron Works, Clinton, Ia., $50,100; Modern Steel Structural Co., Waukesha, Wis., $50,000; Joliet Bridge & Iron Co., Joliet, Ill., $49,800; Minneapolis Steel & Mchry. Co., $48,300; Bayne & Hewett, Minneapolis, $47,987; Milwaukee Bridge Co., Milwaukee, Wis., $52,600, and J. C. Morrison, Dayton, O., $58,000.

The City Council on Nov. 24 passed an ordinance providing for a bridge over the Great Northern right of way at Superior Ave.

Kansas City, Mo.—Local press reports states that plans as submitted by the Kansas City Belt Line Ry. Co. for the viaduct over its tracks at Kansas Ave. provide for a steel structure 75 ft. long, with stone abutments, to cost $17,000.

Columbus, O.—Bids were opened on Nov. 2 by the Bd. of Pub. Service, (Julian Griggs, Ch. Engr.) for the construction of sewage purification works: The following are the totals of bids received, which includes gates, valves, gate house, pump house, etc., also unit prices on some of the items required: (*a*) Engineer's estimate, $474,960; (*b*) Sullivan, Murphy & Miles, Columbus, $435,841 (awarded contract): (*c*) Westwater & Casey, Columbus, $484,158 (*d*) J. H. Louchheim, Philadelphia, Pa., $486,761; (*e*) The Ferro-Concrete Cons. Co., Cincinnati, $532,271; (*f*) Keeling & Ridge Co., Cincinnati, $584,642.

	a	**b*	*c*	*d*	*e*	*f*
125,000 cu. yds. excav. above elev. 6.0	$0.35	$0.40	$0.69	$0.33	$0.29	$0.40
1,450 cu. yds. excav. below elev. 6.0	1.50	2.00	1.50	2.50	2.00	.60
3,000 cu. yds. rolled embkmt.	.20	.40	.15	.20	.60	.20
9,500 cu. yds. loam	.40	.40	.30	.30	.24	.40
40 acres seeding	40.00	25.00	10.00	40.00	24.00	100.00
2,500 sq. yds. sodding	.30	.15	.30	.30	.48	.50
60 cu. yds. broken stone or gravel backing	.65	1.50	.75	1.00	1.20	2.00
30 cu. yds. stone paving	2.50	4.00	3.00	3.00	7.20	7.00
1,300 cu. yds. gravel in roadways	.75	1.25	1.00	1.00	1.00	1.50
1,500 lin. ft. paved gutter	.60	.40	.50	.60	.48	1.00
50 sq. yds. granolithic pavement	1.75	1.50	1.50	2.25	1.44	2.25
21 cu. yds. brick masonry	12.00	9.00	9.00	11.50	18.00	20.00
15 cu. yds. concrete, Class A	30.00	15.00	6.45	20.00	12.50	15.00
540 cu. yds. concrete, Class B	12.00	15.00	6.45	9.30	14.62	10.00
3,570 cu. yds. concrete, Class C	8.00	8.00	6.45	7.50	10.60	8.25
2,290 cu. yds. concrete, Class D	7.50	5.50	6.45	7.80	8.65	7.00
14,330 cu. yds. concrete, Class E	6.50	4.50	6.45	6.60	7.00	6.00
3,600 cu. yds. concrete, Class F	6.00	4.00	6.45	5.20	5.00	7.00
85 tons twisted steel rods	70.00	60.00	54.00	65.00	62.40	75.00
40 lin. ft. 3-in. vitr. sewer pipe	.15	.05	.10	.07	.12	.35
18,300 lin. ft. 5-in. vitr. sewer pipe	.15	.11	.10	.24	.15	.15
10,400 lin. ft. 6-in. vitr. sewer pipe	.18	.13	.12	.24	.155	.20
580 lin. ft. 15-in. vitr. sewer pipe	.60	.44	.60	.66	.58	1.25
630 lin. ft. 21-in. vitr. sewer pipe	1.10	.73	.70	1.20	.96	2.25
80 lin. ft. 24-in. vitr. sewer pipe	1.50	.92	1.00	1.32	1.20	2.50
530,000 lin. ft. 6-in. lateral collectors	.08	.065	.075	.07	.12	.20
196 tons c. i. pipe	40.00	32.00	33.00	40.00	115.00	60.00
32 tons bell and spigot special castings	75.00	80.00	75.00	80.00	65.00	100.00
3 tons flange special castings	90.00	100.00	90.00	100.00	72.00	150.00
82,000 cu. yds. broken stone filtering material	1.50	1.57	1.50	1.68	1.58	1.25
2,950 lin. ft. wrought iron pipe railing	1.00	.60	.75	1.50	1.80	.75
58,500 lbs. iron castings	.035	.04	.03	.04	.04	.07
45,000 lbs. structural steel	.04	.04	.04	.04¾	.04	.07

North Wales, Pa.—The question of constructing a sewerage system here is reported under consideration.

Lansford, Pa.—The Borough Secretary writes that it is proposed to construct a sewerage system at a cost of $25,000. Engineer, Louis Reibe.

Ennis, Tex.—J. D. Riley and J. E. Grayson are reported to have petitioned Council for a franchise for a sewerage system. W. E. Bradley, City Secy.

Petersburg, Va.—Bids will be received until Dec. 18 by the Chmn. Com. on Sewers, Sidewalks and Water Mains, care of the City Engr.'s office, for constructing about 6 miles of terra cotta pipe sewer. R. D. Budd, City Engr.

Pasco, Wash.—See "Power Plants, Gas and Electricity."

Huntington, W. Va.—John H. Sanborn, City Engr., writes that it is proposed to construct a sewerage system, to cost about $45,000.

BRIDGES.

Notes Arranged Alphabetically by States.

Ft. Smith, Ark.—See "Electric Railways."

**Ventura, Cal.*—The contracts for constructing bridges over Ventura River (bids opened Nov. 9 by Bd. Superv.) are reported to have been awarded as follows: The Clinton Bridge & Iron Wks., of Clinton, Ia., for the Sespe Bridge, at $28,400, and the Burrel Constr. Co., of Oakland, the Ventura Bridge, for $18,500.

Middletown, Conn.—See "Railroads."

Rockport, Ind.—Bids will be received until Dec. 5 at the office of A. P. Fenn, Aud., Perry Co., at Cannelton, and until Dec. 6 at the office of J. T. White, Aud. Spencer Co., at Rockport, for constructing a steel bridge over Anderson River, on old abutments, to be 150 ft. span and have a 14 ft. roadway. Bids are invited for bridges of both 100 and 150 lbs. capacity.

Wiscasset, Me.—See "Railroads."

**Springfield, Mass.*—The contract for furnishing material and laying a wooden floor system upon the bridge over Connecticut River between Chicopee and West Springfield is stated to have been awarded to the R. T. Hawkins Iron Wks., of Springfield, for $13,375. Bids opened Nov. 15 by the Bd. County Comrs.

Salem, Mass.—The Comrs. of Essex County are stated to have filed with the Mass. Harbor and Land Comrs. for their approval plans for a steel draw span about 164 x 30 ft.

New York, N. Y.—Pres. T. B. Rhodes, of the City & County Contract Co., which is building the New York, Westchester & Boston Ry., announced on Nov. 25 that he is prepared to let contracts for 16 steel bridges. All of these bridges are located between West Farms and the northern boundary of the city. This is the portion of the line within the limits of the Borough of the Bronx. Plans, specifications and proposal forms can be obtained from Wm. A. Pratt, Ch. Engr. of the Ry. Co., 30 Broad St. Bids will be received by the City & County Contract Co., which also has offices at 30 Broad St., on Dec. 9th. The successful bidder will be required to furnish a bond of $25,000 for completion of the work on or before July 1, 1906.

Geo. E. Best, Comr. of Bridges, has sent a communication to the Bd. of Estimate, which has been referred to its Chief Engineer, Nelson P. Lewis, showing general plans for the proposed Hendrick Hudson memorial bridge at Spuyten Duyvil Heights; it will cost $3,000,000 to purchase land and construct bridge.

Bids will be received until Dec. 7 by Louis F. Haffen, Pres. Boro. Bronx, for widening the bridge over the N. Y., N. H. & H. R. R., at 177th St. Engineer's estimate: 340,000 lbs. iron and steel; 85 cu. yds. Class "A" concrete; 200 cu. yds. Class "B" concrete; 2,650 sq. ft. woven wire fabric; 850 sq. yds. sheet asphalt pavt.; 530 sq. yds. asphalt block pavt.; removing, relaying and connecting water pipe, etc., Boro. Bronx.

Norristown, Pa.—Bids will be received until Dec. 27 by the Comrs. of Montgomery and Chester Counties at the court house at Norristown, for furnishing material and constructing an intercounty highway bridge over Schuylkill River, near Saratoga Station on the P. & R. R. R. Separate bids to be submitted for the substructure and superstructure. John H. Dager, Engr. Robt. C. Miller, Clk. Montgomery Co. Comrs., Norristown.

**Charleroi, Pa.*—It is stated that the contract for constructing a bridge over Monongahela River at North Charleroi has been awarded to the American Bridge Co., Frick Bldg., Pittsburg, for $250,000.

San Marcos, Tex.—B. G. Neighbors, Secy. San Marcos Valley Interurban Ry. Co., writes that it is proposed to construct a bridge over Blanco River.

Houston, Tex.—See "Miscellaneous."

West Fork, W. Va.—C. C. Bee, Pres. West Fork Bridge Co. writes that bids will probably be received about Apr. 1 for the construction of a bridge over West Fork River, to cost about $5,000.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Pine Bluff, Ark.—John P. Harper, City Engr., writes that it is proposed to pave W. 4th St. with macadam 12 in. thick, at a cost of about $40,000.

Santa Ana, Cal.—See "Power Plants, Gas and Electricity."

**San Francisco, Cal.*—The Bd. of Wks. Comrs. is stated to have awarded on Nov. 16 the following paving contracts: portion of Stevenson St., to C. S. Harney, at $8,623; Stockton St., to City Street Improvement Co., 10 Mills Bldg., for $10,376, and Pacific St., to Flinn & Treacy, 302 Montgomery St., for $10,952.

Live Oak, Fla.—S. P. Mays, City Clk., writes that the citizens voted Nov. 21 to issue $75,000 bonds for street improvements.

Peoria, Ill.—The City Engineer is reported to have estimated the cost of paving N. Jefferson Ave. with brick at $24,661; also for paving with brick on Glen Oak Ave., at $16,382.

East St. Louis, Ill.—See "Sewerage and Sewage Disposal."

Princeton, Ind.—It is reported that bids will be received until Dec. 9 by the Bd. Co. Comrs. for constructing about 12,495 ft. macadamized road in White River Township. H. R. Embree, Co. Aud.

Knox, Ind.—It is reported that bids will be received until Dec. 11 by the Bd. Co. Comrs. for improving and constructing 3 gravel roads in Railroad Township, in all about 21½ miles; also 7 gravel roads in Oregon Township, in all about 25 miles. L. W. Ransbottom, Co. Aud.

Michigan City, Ind.—The City Engineer has been instructed by the Bd. of Pub. Works to prepare plans for paving Baltimore, Elston and Ann Sts. with brick, about 50,000 sq. yds; also for 1,500 ft. of 12-in. sewer on Elston St.

Laporte, Ind.—It is stated that Laporte County will soon vote on the proposition of macadamizing about 25 miles of highway.

Shelbyville, Ind.—It is reported that bids will be received by E. C. Newton, City Clk., until Dec. 12, for paving portions of Harrison Ave. and Harrison and Washington Sts. with Warren's bitulithic pavt.; also paving the sidewalks of Walker St. with brick.

**Corydon, Ia.*—The Comrs. of Harrison County are stated to have awarded the contract for constructing a turnpike in Spencer Township to Stoebler & Fisher, at $11,397.

Des Moines, Ia.—The following are reported to be the lowest bids received for paving portions of various streets (price given per sq. yd.): 28th St., with asphalt, Barber Asphalt Paving Co., $1,86, and O. P. Herrick, with brick, W. 8th St., $1.55; Cherry St., $1.53; alley between 14th, 15th and Pleasant Sts., $1.68.

Chanute, Kan.—It is stated that the Tioga Road Com. will soon let the contract for macadamizing about 1½ miles of road in Chanute.

**New Orleans, La.*—The Finance Com. is reported to have recommended awarding the contract for constructing a municipal asphalt repair plant to Warren Bros.; probable cost of plant, $31,690.

Winona, Minn.—It is stated that the driveway around Lake Winona will be macadamized at a cost of $25,000. The length of road is about 8 miles.

**Trenton, N. J.*—G. W. Page, Jr., is reported to have received the contract for repaving with brick on N. Clinton St.

Rensselaer, N. Y.—John G. Salt, City Clk., writes in regard to bids which were opened on Oct. 17 for curbing and paving with asphalt Riverside Ave., that contract has not been let, and will probably not be until the spring.

New York, N. Y.—Bids will be received until Dec. 7 by Louis F. Haffen, Pres. Boro. Bronx, for repaving with asphalt and asphalt blocks on a concrete foundation the intersections of numerous streets. Engineer's estimate: 4,100 sq. yds. completed asphalt block pavt., and keeping same in repair for 5 years from date of acceptance; 980 cu. yds. concrete, including mortar bed; 900 lin. ft. new curb., furnished and set in concrete; 2,400 sq. yds. completed asphalt pavt., including binder course and keeping pavement in repair for 5 years from date of acceptance. Also regulating, grading, curbing and flagging the sidewalks, etc., in a portion of Fox St. Engineer's estimate: 4,300 sq. ft. new flagging, furnished and laid; 950 cu. yds. rock excav.; 975 lin. ft. new curb, furnished and laid; 1,200 cu. yds. filling, etc., all in Boro. Bronx.

Bids will be received until Dec. 12 by Louis F. Haffen, Pres. Boro. Bronx, for regulating, grading, curbing, flagging, sidewalks, etc., in a portion of E. 197th St., Boro. Bronx.

Buffalo, N. Y.—John Seibert, Jr., is reported to have submitted the lowest bid for repairing asphalt paved streets throughout the city, at 74 cts. per sq. yd.

Syracuse, N. Y.—Bids will be received until Dec. 11 (readvertisement) by the Bd. Contract and Supply for furnishing material and paving a portion of Leavenworth Ave. with Hallwood, Mack, Johnsonburg, Pittsburg, Buffalo, Shawmut or Syracuse brick of standard grade or quality; also Highland St. with natural asphalt sheet pavt. Geo. J. Metz, City Clk.

Brooklyn, N. Y.—Bids will be received until Dec. 13 by Martin W. Littleton, Pres. Boro. Brooklyn, for regulating, grading, curbing, paving and laying sidewalks on numerous streets. Engineer's estimate: 10,155 sq. yds. asphalt pavt.; 10,820 sq. yds. asphalt block pavt.; 155,250 sq. ft. cement sidewalk; 42,247 sq. ft. cement concrete sidewalk; 12,764 lin. ft. new curb; 7,966 lin. ft. combined concrete curb and gutter; 3,142 cu. yds. concrete; 12,653 cu. yds. earth excav., etc.

Long Island City, L. I., N. Y.—Bids will be received until Dec. 12 by Jos. Cassidy, Pres. Boro. Queens, for regulating, grading, curbing and repaving with wood block pavt. on a concrete foundation a portion of Union Ave., Boro. Queens. Engineer's estimate: 1,100 sq. yds. wood block pavt.; 1,250 lin. ft. new concrete curb, furnished and set; 150 cu. yds. concrete, including mortar bed; also a portion of 3d Ave., College Point, Boro. Queens. Engineer's estimate: 7,650 sq. yds. wood block pavt.; 6,100 lin. ft. concrete curb, furnished and set; 1,000 cu. yds. concrete, including mortar bed.

** Items marked thus give the names of parties awarded contracts.*

Brooklyn, N. Y.—See "Miscellaneous."

Elyria, O.—Bids will be received until Dec. 26 by Frank R. Fauver, City Aud., for $18,000 bonds, for grading, draining, curbing and paving Middle Ave.

Akron, O.—City Engr. Payne is stated to have estimated the cost of paving Good St. at $6,649.

Cleveland, O.—The construction of a boulevard from Lake View Park to Gordon Park is reported under consideration.

**Delaware, O.*—F. D. King, City Aud., writes that the contract for macadamizing a portion of Catharine St. and Pennsylvania Ave. has been awarded to J. F. Gantz, of Delaware, for about $3,800.

Cincinnati, O.—Bids will be received until Dec. 19 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for the construction and repair of artificial stone sidewalks in the Eastern and Western Sidewalk Dists.; also paving and repaving brick sidewalks in said districts.

Norwood, O.—Bids will be received until Dec. 16 by the Bd. Pub. Service (J. E. Thorpe, Clk.) for furnishing material and improving a portion of Norwood Ave., by grading, curbing and macadamizing. J. A. Stewart, City Engr., 813 Traction Bldg., Cincinnati.

Philadelphia, Pa.—See "Miscellaneous."

**Homestead, Pa.*—The Pennsylvania R. R. Co. is reported to have awarded the contract for grading and paving Elder Alley and the freight yards to F. J. Erbeck & Co., for about $14,000.

Norristown, Pa.—The Montgomery County Comrs. are stated to have reported favorably on the construction of a road 3,250 ft. long on the line between Cheltenham and Abington Townships in the Borough of Jenkintown.

Scranton, Pa.—The Common Council Pub. Wks. Com. is reported to have reported favorably the ordinance providing for the paving with bitulithic on Pittston Ave.

Knoxville, Tenn.—Church Ave., west from Prince to Henly Sts., Main St., west from Prince to B'way., Walnut St., west from Clinch to W. Main St., and 5th Ave., from Gay to Florida St., are to be paved with brick, asphalt or bitulithic, in all about 40,000 yds.

Sherman, Tex.—Bids will be received by Henry Zimmerman, City Secy., until Dec. 18 for paving portions of Crockett, Travis, Houston and Mulberry Sts., with vitrified brick, asphalt, or bitulithic pavement, as advertised in The Engineering Record; probable cost of work $28,000. Chas. E. Haydon, City Engr.

**Walla Walla, Wash.*—The Warren Constr. Co., of Portland, Ore., is stated to have secured the contract for paving 4th, Elm and Spokane Sts., for $75,000.

Washington, D. C.—Bids will be received by B. T. Galloway, Chmn. Bldg. Com., U. S. Dept. of Agriculture, until Jan. 5, for the installation of the electric wiring and conduit systems of two laboratory buildings, for the U. S. Dept. of Agriculture, as advertised in The Engineering Record.

Bids will be received until Dec. 12 at the Bureau Supplies and Accounts, Navy Dept., Washington, to furnish at the navy yards, etc., Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; League Island, Pa.; Washington, D. C.; and Norfolk, Va., a quantity of naval supplies as follows: Schedule 246, Electrical wire and supplies, poles, metallic packing. Schedule 247, Generating sets, etc. Schedule 248, Bevel gears, iron bends, etc. Schedule 249, Bar steel, etc. Schedule 250, Pig iron, steel floor plates, sheet and spring steel, copper pipe, etc. Schedule 251, Pipe fittings, etc.; also on Dec. 26 to furnish at the Navy Yards, Mare Island, Cal.; and Puget Sound, Wash., a quantity of naval supplies as follows: Schedule 253, Wood boring machine, tool steel, asphalt felt, asphaltum cement. Schedule 254, Searchlight. Schedule 255, Carborundum wheels, galvanized sheet steel, zinc plates, lead pipe, motors, etc. Applications for proposals should designate by numbers the schedules desired. H. T. B. Harris, Paymaster Gen., U. S. N.

The lowest bid received and opened on Nov. 25 by the Superv. Archt., Treas. Dept., Washington, for furnishing and placing lighting fixtures in the west outbuilding of the U. S. Bureau of Engraving and Printing, was submitted by Horn & Brannon, of Philadelphia, Pa., for $2,918.

De Land, Fla.—J. H. Kruse, Supt. Citizens' Mfg. Co., writes that this company has just been formed, with a capital of $50,000, to manufacture gas and ice. Work will begin at once.

Chicago, Ill.—Bids will be received until Dec. 6 by Wm. Carroll, City Electrician, for furnishing the Dept. of Electricity with auxillary header and steam piping, to be delivered and installed at the H. N. May municipal electric light station, Fullerton Ave. and Chicago River; also one marble switchboard, equipped with switches, wattmeters, ammeters, and voltmeters; about 1,000 ft. of 300,00 C. M. stranded cable, rubber and braid insulation for 250 volts; about 1,000 ft. No. 3 B. & S. G. stranded conductor cable, R. & B. insulation, for 10,000 volts, to be delivered and installed at City Hall.

Belleville, Ill.—The Belleville Gas & Electric Co. is reported to have decided to expend about $30,000 in improvements, including new engine and generator.

Mt. Ayr, Ia.—The citizens are reported to have voted to grant a franchise to the Mt. Ayr Gas. Co. to construct and maintain a gas and fuel plant, to cost about $15,000. M. E. Springer, of Des Moines, is the promoter.

**Seattle, Wash.*—The following are the bids opened Nov. 18 by the Bd. of Pub. Wks. for concrete sidewalks on 6th Ave. N. and other streets: (*a*) Hans Pederson, Alaska Bldg., (*b*) Coast Concrete Co., Pacific Blk., (*c*) McAdam & Cannon, (*d*) Sparger Concrete Co., Colman Blk. (awarded contract):

	a	*b*	*c*	**d*
Fixed estimate	$1,000.00	$1,000.00	$1,000.00	$1,000.00
1,500 cu. yds. earthwork	.20	.30	.50	.10
191 M. ft. curb, etc	15.00	16.00	15.50	15.00
80 M. ft. crosswalks	15.00	16.00	14.50	14.00
13,650 sq. yds. concrete sidewalks	.93	.95	1.10	.94
730 sq. yds. concrete alley crossings	1.10	1.25	1.30	1.10
9 catch basins (double inlets)	70.00	70.00	75.00	68.00
28 catch basins (single inlets)	60.00	65.00	65.00	60.00
2 single inlets	25.00	25.00	25.00	15.00
4,500 lin. ft. 3-in. sewer pipe	.10	.10	.12	.06
10 M. ft. crosswalks, relaid	5.00	7.00	8.00	4.00
2 catch basins, without inlet	50.00	50.00	60.00	45.00
6 inlets to be moved	7.00	5.00	5.00	5.00
Totals	$21,915	$22,906	$25,214	$21,571

**Spokane, Wash.*—The Bd. of Pub. Wks. is stated to have awarded the contract for constructing sidewalks on a portion of Washington St. to Barber Asphalt Paving Co., of Spokane, for $11,168.

Huntington, W. Va.—John H. Sanborn, City Engr., writes that it is proposed to lay about 100,000 sq. yds. vitrified brick paving, with cement curb and gutter, and contracts will probably be let the first of the year; probable cost of work $150,000.

Niagara Falls, Ont.—Bids will be received until Dec. 14 by John Robinson, City Clk., for $16,785 brick road-

POWER PLANTS. GAS AND ELECTRICITY

Notes Arranged Alphabetically by States.

Albertville, Ala.—It is reported that work will probably soon commence on the power plant to be erected on Town Creek, near Albertville, by the North Alabama Ry., Light & Power Co.

Phoenix, Ariz.—L. M. Hoghe is reported to have petioned council for an electric light and gas franchise.

Santa Ana, Cal.—The Edison Gas & Electric Co. is reported to have decided to enlarge its gas plant.

The City Council is reported to be considering the calling of an election to vote on issuing $140,000 bonds, to be used for the construction of a gas, electric light and power plant, and for street improvements.

San Bernardino, Cal.—The stockholders of the Home Gas Co. are reported to have decided to double the capacity of its plant.

Halfmoon Bay, Cal.—The Supervisors of San Mateo County, at Redwood City, have received from W. E. Alexander a petition asking for a franchise to lay mains in the streets of Halfmoon Bay and to erect and maintain poles and wires for supplying gas and electricity to the town for light, heat and power.

Chico, Cal.—The City Trus. are reported to have granted the Northern Electric Co. permission to enter the city by way of Main St.

Visalia, Cal.—A. G. Wishon, of Fresno, is reported to have secured a franchise to construct a power line in and across Tulare County.

The Mt. Whitney Power Co. is reported to have completed arrangements for the construction of an auxiliary steam plant in this city of 1,500 horse-power.

Redding, Cal.—The Bd. of Superv. is reported to have granted a franchise to the Shasta Power Co.

Lampoc, Cal.—The Bd. of City Trus. are reported to have granted J. M. Stamp, a franchise for an electric light plant.

Corning, Ia.—The Corning Light & Heat Co. is reported incorporated, with a capital of $30,000, by C. R. Munns and others.

Osawatomie, Kan.—W. H. Murphy is reported to have decided to construct an electric light plant here.

Campton, Ky.—The Campton Fuel & Light Co. is reported incorporated with a capital of $8,000, by A. F. Byrd, of Winchester; Chas. Kerr, of Lexington; J. H. Stamper, Jr., of Campton, and others.

Augusta, Ky.—Bids will be received by J. P. Reese, Clk. of Committee, until Dec. 8, for the installation of a municipal electric light plant, as advertised in The Engineering Record. Bids are wanted on separate divisions, also on a complete plant.

Louisville, Ky.—It is stated that about $150,000 will be expended by the Louisville & Nashville R. R. Co. (W. H. Courtenay, Ch. Engr., Louisville, Ky.) in a central heating and power plant, to be located in the new office building on 10th St. and Bway.

Red Wing, Minn.—P. C. Thompson and others, of Detroit, Mich., are reported to have purchased the gas and electric light plant and will make extensive improvements.

St. Louis, Mo.—Surveyors are stated to have completed the preliminary work preparatory to the construction of a canal connecting Missouri River with Meramac River, for the development of electric power for use in St. Louis. Westinghouse, Church, Kerr & Co., of New York, N. Y., are said to be preparing a report on this project.

Reno, Nev.—Engineers W. D. Arnett & Co., of Reno, write that the engineering work has not yet been completed for the proposed electric plant to be constructed on Truckee River.

Yerington, Nev.—C. W. Fancher and Thos. Harris, both of San Jose, Cal., are reported interested in the construction of a power plant to be located in the canyon between the Matthews and Boerlin ranches.

Little Falls, N. J.—The Economy Light, Heat & Power Co. is reported to have petitioned for a franchise in Little Falls Township. H. W. Wood, of Little Falls, and W. C. Clift, of Newark, are among the incorporators of this company.

Paterson, N. J.—The Parral Power Co., of Paterson, is reported incorporated, with a capital of $500,000, by John L. and Harry E. Griggs and Wm. L. Berdan.

Albion, N. Y.—The Niagara Falls Electric Transmission Co. is reported to be seeking a right of way through Orleans County. Work on the new line will begin in the spring.

Brooklyn, N. Y.—The Municipal Lighting Comn. of N. Y. City estimates the cost of constructing an electric light plant with sufficient capacity to furnish the boroughs of Brooklyn and Queens with electricity, at $6,138,000. If the city decides to build a plant to do away with gas lighting entirely, it will cost $9,485,000.

The Bd. of Estimate on Nov. 24 appropriated $175,000 to put underground all electrical wires and conduits in the boroughs of Brooklyn and Queens.

*The following are the bids opened on Nov. 27 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing electric equipment in School 149, Brooklyn Boro.: Commercial Constr. Co., $15,428; Fred. Pearce, 18 Rose St., N. Y. City, $14,800 (awarded contract); Peet, McAnerney & Powers, $15,341; O. K. Electric Constr. Co., $16,200; Reis & O'Donovan, $15,685, and W. M. Sheehan & Co., $14,937.

Byron, N. Y.—The Town Trus. are reported to have granted a franchise to the Niagara, Lockport & Ontario Power Co.

Miamisburg, O.—The City Council is reported to have granted a gas franchise to the Ohio Fuel Supply Co.

Cincinnati, O.—Geo. R. Belch, Vice-Pres. Cincinnati Realty Co., writes that bids will be received about Jan. 15, for the construction of a power plant for the 4th St. Hotel, to cost about $160,000.

McMinnville, Ore.—This city is reported to have sold bonds, to be issued for the construction of water works and an electric light plant.

Elgin, Ore.—H. D. Spencer and John D. Sappring are reported to have purchased the electric light plant and will make improvements to same.

Haines, Ore.—The Hot Springs Electric Light Co. is reported incorporated with a capital of $5,000, with W. J. Mays, of Baker City, and J. F. O'Bryan, of Haines, as incorporators.

Etna, Pa.—Bids will be received until Dec. 5 by A. R. Dunlap, Boro. Clk., for one direct-current arc light machine, to be installed at the Boro. electric light plant.

Bamberg, S. C.—It is reported that the Bd. of Pub. Wks. wants prices on a 90-kw. generator, two 125-hp. boilers and a 125-hp. engine (Corliss or 4 valve is being considered); plant to consist of 40 arcs and at least 1,000 incandescents. G. M. Dickinson, Mayor.

Aberdeen, S. D.—F. W. Raymond, City Auditor, writes that the proposed electric light plant will cost about $35,000. D. C. Washburn, City Engr.

South Pittsburg, Tenn.—This city is reported to be negotiating for the purchase of the electric light and water plant, and an engineer is reported to be estimating cost of improvements to same.

Shenandoah, Va.—A. R. Martin, Town Clk., writes that the Town Council has awarded to Geo. C. Morgan, of Chicago, Ill., the contract to construct a combined water works and electric light and power plant. Bids for machinery and material will be received by A. R. Martin, Town Clk., until Jan. 2; probable cost, $30,000. Engineer, Arthur M. Morgan, 808 Royal Insurance Bldg., Chicago, Ill.

Pasco, Wash.—It is stated that bonds will probably be issued for the construction of water works, a sewerage system and an electric light plant.

Tacoma, Wash.—Frank L. Davis, City Engr., writes that no bids were received on Nov. 18 for constructing a water power electric generating plant.

Mannington, W. Va.—A charter has been granted to the Mannington Gas Co., of Mannington, with capital of $50,000. Incorporators: O. N. Koen, W. C. McBride, F. R. Stewart and others.

Washburn, Wis.—R. Hering, City Clk., writes that the Council is considering the question of constructing municipal electric light plant. Franchise expires next year.

Madison, Wis.—It is reported that a $250,000 heating and power plant is to be constructed by the University on University Ave., bet. Charter and Bruen Sts., to cost about $250,000.

Stratford, Ont.—The Water Comrs. are reported to be considering the question of running an electric light plant in connection with the water works.

San Juan, Porto Rico.—The question of municipal ownership of the water works and electric light plant is reported under consideration here.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Ft. Smith, Ark.—The Ft. Smith Light & Traction Co. is stated to have received a 50-yr. franchise for an electric railway, and will construct a bridge across Arkansas River, at a cost of $300,000.

Stockton, Cal.—The Central California Traction Co. is reported to have been granted a franchise to construct an electric railway over San Joaquin County roads.

Vallejo, Cal.—The East Shore Electric Ry. Co. is reported to be obtaining rights of way for a line from San Pablo to Vallejo Junction.

**Norwich, Conn.*—The directors of the Norwich-Westerly Electric Ry. Co. are stated to have decided to give the contract for building the road to the National Constr. Co., of New York, N. Y. The cost and equipment of the road will be over $500,000. It is understood that work will be started as soon as possible at both ends of the line.

Payette, Idaho.—It is stated that the American Constr. Co., of New York, N. Y., has made the Commercial Club a final proposition to build an electric railroad between Payette and New Plymouth, 13 miles south. The club is reported to have accepted the proposition.

Decatur, Ill.—At an adjourned meeting of directors of the Decatur, Mattoon & Sullivan Traction Co., held at Decatur recently, details of organization were completed and surveys authorized from Mattoon to Decatur, 42 miles. R. B. Starbuck, Pres., Mattoon, Ill.; Col. J. M. Clokey, Vice-Pres., Decatur; W. A. Steele, Secy & Treas., Sullivan; E. C. Craig, Att'y., Mattoon; A. M. Shaw, Engineer in Charge, Dixon.

** Items marked thus give the names of parties awarded contracts.*

Joliet, Ill.—The Joliet & Southern Traction Co. is reported incorporated, with a capital of $10,000, for the erection of a road through County Will, Grundy and Livingstone to Dwight. Incorporators: F. E. Fisher, F. E. Stoddard and J. A. Starvis.

Kokomo, Ind.—The construction of an extension to the Kokomo, Marion & Western Traction line from Kokomo west to Burlington, Flora and Delphi, with the ultimate purpose of connecting with the line building from Lafayette to Chicago, is reported under consideration. T. C. McReynolds, Mgr., Indianapolis.

Tulsa, Ind. Ter.—The City Council has granted a franchise for the construction of a street car line in Tulsa. L. F. Parker, of St. Louis, Mo., is reported interested.

Biddeford, Me.—Thomas F. Deegan, of Philadelphia, Pa., Pres. The Traction Co. of America, is reported to have closed a contract for building the Pool Electric R. R. (Chas. M. Moses, of Portland, Pres.). This line is to be 16 miles long, and will extend from Portland to Biddeford.

Skowhegan, Me.—The construction of a third-rail electric line from Skowhegan to Farmington, to run through Norridgewock, Mercer, New Sharon and Farmington Falls, is reported under consideration. The length of the road is about 28 miles.

Frederick, Md.—It is stated that the Washington, Frederick & Gettysburg Electric Ry. Co. has in contemplation the construction of an electric railway from Frederick to Thurmont by way of Yellow Springs and Lewistown. D. Columbus Kemp, Pres.; Chas. C. Waters, Secy.

St. Louis, Mo.—The St. Louis, Fern Ridge & Western Ry. Co. (Wm. E. Pfister, of Creve Coeur, Pres.) is reported to have been granted a franchise to build and operate a single or double-track railway on Olive St., from 66th St. to Creve Coeur Lake.

Albany, N. Y.—The Bd. of Contract and Supply is reported to have granted the franchise for the construction of a double-track street railway from Madison Ave. and Allen St. along S. Allen St. to Cortland St. to John W. McNamara, representing the Capital City Ry.

Cleveland, O.—The Roberts & Abbott Co. is reported to be preparing preliminary plans and profiles for the proposed Cleveland, Ashland & Mansfield Ry. Col. C. V. Hurd, of Wooster, is reported interested.

Portland, Ore.—The Portland-Salem Electric Ry. Co. is reported to have filed articles of incorporation in the County Clerk's office. Capital, $100,000. Incorporators: W. J. Walsh, L. H. Cordes and H. Dunn. The company proposes to construct an electric railway between Portland and Salem; also to construct and operate electric light plants, telegraph and telephone lines, etc.

Salem, Ore.—The Willamette Valley Traction Co., with a capital of $1,250,000, is reported incorporated by Jas. F. Pershing, of Chicago, Ill.; C. B. Rhodes, of Philadelphia, Pa.; A. Welch, of Salem, and others. This company proposes to construct and operate a double-track railway from Portland south to a point on the Willamette River, near Wilsonville, 23 miles from Portland, then across the river and south to Roseburg.

Spearfish, S. D.—Richard B. Hughes, of Spearfish, Vice-Pres. Black Hills Traction Co., writes that the company is now excavating a canal about 5 miles in length from Redwater River to generate power. It has not yet been decided what kind of plant will be constructed.

Bellingham, Wash.—The Nooksack Valley Rapid Transit Co. is reported to have filed articles of incorporation with the Secretary of State. The company purposes to take over the franchise granted by the County Comrs. to Edward Brown and associates. The objects are to construct and operate lines of railway from Bellingham to Marietta, Ferndale, Custer, Birch Bay and Blaine, another line to Lynden and Sumas; also a line from Custer to Lynden. Capital $500,000. Incorporators: Ed. Brown, of Custer; Jas. Morrison, of Ferndale; A. J. Welch, of Bellingham, and others.

Centralia, Wash.—The City Council is stated to have passed the ordinance of the Centralia-Chehalis Electric Ry. & Power Co. for a franchise to operate electric cars on the streets of Centralia. The ordinance provides for a single-track line from the Driving Park in the north end of the city in an almost direct line to the city limits on the south.

North Yakima, Wash.—The petition of the North Yakima & Valley Ry. Co. for a right of way across the county roads for the Naches Valley branch is reported to have been granted by the County Comrs. The right of way is for the entire line from North Yakima to the Naches Valley.

Walla Walla, Wash.—The City Council is stated to have granted a franchise to the North Coast Ry. Co. to lay its track on 9th St., from the south side to the east side, with a spur on Rost to 6th Sts. Robt. E. Strahorn is reported interested.

Toronto, Ont.—The Toronto & Niagara Power Co. is reported to have given the Toronto & Hamilton Ry. Co. power to build and operate its line between Toronto and Niagara Falls on the Power Co.'s right of way.

RAILROADS.

Notes Arranged Alphabetically by States.

Troy, Ala.—W. H. Booth, Pres. Pea River Valley & Gulf R. R. Co., writes that it is proposed to construct a steam railroad from Opelika to Portland, Fla., a distance of about 187 miles, at a cost of about $2,500,000. No engineer as yet in charge. The company will construct the greater portion of the road with its own men.

San Francisco, Cal.—The stockholders of the Western Pacific R. R. Co. are reported to have authorized the issuance of $25,000,000 second mortgage bonds. The new bond issue may not be floated, and has merely been authorized as a guarantee to the holders of the $50,000,000 of first mortgage bonds that sufficient money will be raised if necessary, and promptly, to complete the construction of the new line from here to Salt Lake should the $50,000,000 already raised prove insufficient to meet the cost of construction. The Utah Constr. Co., Salt Lake City, Utah, are reported to be the contractors for this road.

Hartford, Conn.—We are informed that details and cost of abolishing the grade crossing at Walnut St. will not be determined for at least two months. F. L. Ford, City Engr.

Middletown, Conn.—The engineers of the New York, New Haven & Hartford R. R. Co. (C. M. Ingersoll, Ch. Engr., New Haven) are reported to be surveying the line between Middletown and Willimantic, with a view to shortening the route between New Haven and Boston, Mass. It is reported that the scheme will involve an outlay of $3,000,000 to double track the division all the way, to build a new bridge over the Connecticut, to cut heavy grades, build new stations and do the other incidental work necessary.

Athens, Ga.—The Central of Georgia Ry. Co. (Henry M. Steele, Ch. Engr., Savannah) is reported to have decided to expend about $100,000 in the improvement of its yards here, including the erection of a depot.

Coeur d'Alene, Idaho.—The S. R. Lewis Lumber Co., of Coeur d'Alene, is reported interested in the construction of a steam railway from Coeur d'Alene to Rockford, Wash., then southeast to the vicinity of Santa, Idaho, a distance of about 75 miles. The road will connect with the Northern Pacific at Coeur d'Alene, and may connect with the O. R. & N. at Rockford. The new railroad will be known as the Idaho Northern.

Henryetta, Ind. Ter.—The Missouri, Oklahoma & Gulf Ry. Co. (F. C. Faust, Ch. Engr., Muskogee, Ind. Ter.) is reported to have decided to construct a line from Henryetta to Shawnee.

Creston, Ia.—The Creston & Western Ry. Co. has been incorporated with a capital of $250,000, by Thos. A. Way, of Mason City, and others. It is understood that the company's plan is to build a line from Arispe to Creston, a distance of about 10 miles. The Great Western will probably operate the road under a long time lease as soon as it is completed. Eventually, it is understood, the company proposes to build northwest from Creston, tapping a considerable territory in Adams, Adair and Cass Counties.

Wiscasset, Me.—The Maine Central R. R. Co. (T. L. Dunn, Ch. Engr., Portland, Me.) is reported to be considering the construction of a railroad from Wiscasset to Kennebec, a distance of 10 miles, with a bridge over Kennebec River, at Abagadasset Point.

Bay City, Mich.—The Detroit & Mackinac R. R. Co. (H. S. Waterman, Ch. Engr., East Tawas) is reported to have decided to extend its line from Bay City to Port Huron.

Marshall, Mich.—The stockholders of the Toledo, Marshall & Northeastern Ry. Co. are reported to have increased its capital from $800,000 to $2,000,000. Work will, it is reported, soon begin on the new steam line from Bay City through Olivet, Marshall and Coldwater to Montpelier, O.

Moorhead, Minn.—The Northern Pacific R. R. Co. (E. J. Pearson, Ch. Engr., St. Paul) is reported to have decided to double track its main line between Moorhead and Brainerd this winter.

Billings, Mont.—Press reports state that work will probably soon commence on the construction of an extension from Billings to Great Falls, for the Great Northern Ry. Co. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.)

Long Island City, L. I., N. Y.—Mayor McClellan is reported to have authorized Nelson P. Lewis, Ch. Engr. Bd. of Estimate of N. Y. City, to take up with Ralph Peters, Pres. Long Island R. R., the question of abolishing its grade crossings in Queens Borough.

Fargo, N. D.—The Northern Pacific R. R. Co. (E. J. Pearson, Ch. Engr., St. Paul, Minn.) is reported to have decided to double track its line from Fargo eastward to Wadena, Minn.

Portland, Ore.—The Portland Seacoast Ry. Co. is reported incorporated to build a net work of railroads over Washington, Tillamook and Clatsop Counties, centering in Portland, and to construct a road the entire length of the Oregon coast to Eureka, Cal. Incorporators: C. H. Wheeler, John Stewart and Wm. Reid.

Philadelphia, Pa.—Press reports state that during 1906 the Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia) will expend about $95,000,000 in improvements.

Local press reports state that Geo. F. Baer, Pres. of the Reading Ry., and Mayor Weaver have reached an agreement for the abolition of the grade crossings. Details are being perfected by the engineers of the city and the railroad. Within 30 days, it is said, the first active steps toward the abolition will be taken. According to the terms of the agreement the city concedes to the Reading a lower grade for its track from Huntingdon St., through Tioga to Wayne Junction. Mr. Baer agrees to the city's plan for structural iron work between Girard Ave. and the north side of Jefferson St. The present plans of the city for elevating the Reading's tracks in Richmond are to remain unchanged.

Sharon, Pa.—A press report states that the Erie R. R. (Francis Lee Stuart, Ch. Engr., New York, N. Y.) is considering the improving of the Sharon-New Castle branch, at a cost of about $200,000.

McKinney, Tex.—The Missouri, Kansas & Texas R. R. Co. (S. B. Fisher, Ch. Engr., St. Louis, Mo.) is reported to have decided to construct a railroad from McKinney to Denton.

Richmond, Va.—G. W. Carhart, of New York, N. Y., and R. V. Hilands, Pres. of the Hilands-Gilleson Co., of Philadelphia, Pa., are reported to be here with H. Chester Johnson, of Philadelphia, Pa., their counsel, and say they have become the owners of the franchise of Richmond & Tide Water Ry. and will build the road. The line has been surveyed from Ellerson's, on the Chesapeake & Ohio Ry. in Hanover County; Urbana, on the Rappahannock River. They have named the new road the Richmond, Rappahannock & Eastern R. R.; capital, $1,250,000.

**Norfolk, Va.*—The Virginia & Carolina Coast Ry. Co. is reported to have awarded contract for its roadway construction to J. G. White & Co., of New York, N. Y. The Virginia & Carolina Coast Ry. will extend 142 miles, connecting with the Suffolk & Carolina R. R. on the north, and the Newbern, Oriental & Western on the south. The consolidation of three systems will form a through line from Norfolk to Newbern, N. C., and a new line will extend from Newbern to Beaufort, N. C.

Port Angeles, Wash.—The Port Angeles & Olympia R. R. Co. is reported incorporated, with a capital of $4,000,000, to build, construct, purchase or otherwise acquire a standard-gauge railway from Port Angeles to a point at or near the city of Olympia, to connect with the main line of the Northern Pacific or some other transcontinental road. Incorporators: Lester Turner, Pres. First Natl. Bank, Seattle; M. J. Carrigan, Port Angeles, and others.

Milwaukee, Wis.—The Common Council is reported to have under consideration the question of elevating the tracks of the Chicago, Milwaukee & St. Paul R. R. (D. J. Whittemore, Ch. Engr., Chicago, Ill.) and the Chicago & North Western R. R. (E. A. Carter, Ch. Engr., Chicago, Ill.) on the south side.

Toronto, Ont.—E. H. Fitzhugh, of Montreal, Que., Third Vice-Pres. of the Grand Trunk Ry. System, writes that no decision has yet been reached, regarding the proposal to construct a subway at Parkdale, Toronto.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Colorado Springs, Colo.—Among the contractors who submitted bids on Nov. 15 for the construction of the U. S. Post Office and Court House at Colorado Springs were the Piper Bros. Co., 220 W. 2d St., Pueblo. A previous item reported this firm name as Pyset Co.

Wilmington, Del.—The Trus. of the Homeopathic Hospital, it is stated, are considering the erection of an addition to the hospital at a cost of $50,000.

Washington, D. C.—Bids will be received by B. T. Galloway, Chmn. Bldg. Com., U. S. Dept. of Agriculture, until Jan. 5 for the ventilation, heating and special piping systems of two laboratory buildings, for the U. S. Dept. of Agriculture, as advertised in The Engineering Record.

Bids will be received by the Comrs. D. C. until Dec. 20 for the construction of a public convenience station in reservation 7, as advertised in The Engineering Record.

Pensacola, Fla.—The following are the bids opened Nov. 27 by the Superv. Archt., Treas Dept., Washington, D. C., for the construction of a hospital, wharf, etc., at Santa Rosa Quarantine Station, Pensacola (bidders all of Pensacola): F. M. Donal, $15,990; C. F. Turner, $10,274; Jas. Starns, $16,750, and Henry Mark, $15,750.

Tampa, Fla.—The following are the bids opened on Nov. 27 by the Superv. Archt., Treas. Dept., Washington, D. C., for improvements at Tampa Bay Quarantine Station, Mullet Key, Fla.; H. Walter Fuller, Tampa, $19,989, and W. H. Veading, Lewes, Del., $14,957.

Lyons, Ga.—Geo. C. Thompson, of Dublin, Ga., is preparing plans for Toombs County Court House, to cost between $25,000 and $27,000. Will require stone, terra cotta, pressed brick, galv. iron dome and cornice, steel beams, metal lath, cement plaster, fire shutters and doors for vaults, sash, doors, builders' hardware, etc. For further information address the Architect.

Chicago, Ill.—City Archt. C. F. Hermann, it is stated, is preparing plans for a police station to be erected at Hudson Ave. and Blackhawk St., at a cost of $20,000.

Bowling Green, Ky.—It is reported that $25,000 bonds have been issued for the construction of a city hall and engine house.

New Orleans, La.—F. J. Noullet, it is reported, submitted the only bid for repairs to the city hall (bids for which were opened by the City Council Com. on Finance on Nov. 20) at about $29,000.

Shreveport, La.—It is stated that the city hall, which was burned on Nov. 20, will be rebuilt. Andrew Querbes, Mayor.

**Baltimore, Md.*—J. E. Granbury, of Baltimore, has secured the contract for the boiler plant, heating and ventilating apparatus for the U. S. Custom House at Baltimore (bids opened Sept. 28) for $45,922.

The Second Branch of the Council has passed an ordinance appropriating $23,000 for an engine house, to be erected in the vicinity of Kate Ave. and Reisterstown Road.

John F. Weyler, penitentiary warden, it is reported, recommends the appropriating of $225,000, to erect an addition to the jail.

Worcester, Mass.—The Worcester Art Museum, it is reported, has received $3,000,000 by the will of the late Stephen Salisbury. It is stated that among the improvements to be made with the bequest will be the erection of a new building.

Thompsonville, Mich.—The Superv., it is stated, have passed a resolution authorizing an election to be held to vote on the question of issuing $30,000 bonds to erect a court house.

Detroit, Mich.—The Library Comn., it is stated, has secured a site at Trumbull and Grand River Aves., and it is reported intends erecting a library to cost about $12 000.

**Ft. Wayne (Detroit), Mich.*—Any one wishing to correspond with Wm. Hamilton, who secured the general contract for erecting buildings at this post (bids for which were opened on Oct. 4) at $122,237, should address him at Detroit, Mich., P. O. Box 107.

Minneapolis, Minn.—The Bd. of Charities and Corrections, it is stated, has authorized Lowell A. Lamoreux, Lumber Exchange, to prepare plans for the administration building, which is to be erected at the city hospital at a cost of about $60,000, and it is stated that the Bd. will soon ask bids for the erection of said building.

Eveleth, Minn.—It is stated that a new city hall is to be erected at a cost of $15,000.

Laconia, N. H.—It is stated that the Trus. of the Laconia Hospital are considering the erection of a new hospital and administration building at a cost of $25,000.

Secaucus, N. J.—Bids will be received until Dec. 7 by the Co. Bd. Chosen Freeholders (John P. Egan, Clk.), Jersey City, for erecting an almshouse at Secaucus. Bids may be submitted as a whole or separately on the following: Masonry; carpentry; plumbing and steam heating. C. F. Long, Archt., 1 Montgomery St., Jersey City.

New York, N. Y.—The following are the bids opened Nov. 23 by the Comrs. of Parks for furnishing material and erecting a deer house in the N. Y. Zoological Park in Bronx Park: Behan & Cavanaugh, 44 E. 23d St., $53,947; Buckley Realty Constr. Co., Times Bldg., $42,800; Guidone & Galardi, 1 Madison Ave., $41,543; Kelly & Kelley, Inc., 45 E. 42d St., $48,340; Charles H. Peckworth, 415 Hudson St., $49,577; Springstead & Adamson, 424 E. 107th St., $43,666; Gus L. Walker Co., 3424 B'way, $48,759.

Bids will be received until Dec. 7 by the Dept. of Parks (Sam'l Parsons, Jr., Pres.) for furnishing material and erecting a public comfort station in Pelham Bay Park, in connection with public building already erected; also one in St. James Park; bids will also be received for erecting an addition to the toilet house in Claremont Park, all in Boro. Bronx.

Bids will be received until Dec. 12 by Louis F. Haffen, Pres. Boro. Bronx, for constructing the Bronx Boro. court house, at 3d Ave. and 164th St.

Bids will be received until Dec. 11 by Nicholas J. Hayes, Fire Comr., for furnishing material and erecting a building for a Hook and Ladder Co., at 135th St., near Lenox Ave.

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* *Items marked thus give the names of parties awarded contracts.*

Morrisville, N. Y.—The repair of the old jail at a cost of $20,000, or the erection of an entire new building, is reported under consideration by the Bd. of Superv.

Elmira, N. Y.—H. H. Bickford, it is stated, has submitted plans to the Bd. of Superv. for repairs to the jail which it is proposed making at a cost of about $15,000.

Lima, O.—The City Council, it is stated, has passed an ordinance authorizing the issue of $40,000 bonds for the erection of a new city jail and quarters for the police and fire departments.

Cincinnati, O.—It is reported that the Bd. of Pub. Service has approved plans and specifications for a City Hospital, the cost to be about $1,750,000.

It is stated that plans are being prepared by Des Jardins & Drainie for a 3-story, 50x130-ft. addition which the officials of the Cincinnati Sanitarium, located on College Hill, intend erecting next year at a cost of $50,000.

Lima, O.—The Comn. appointed by the Governor to select a site on which to erect a State Hospital for the Insane, it is stated, has decided upon a site in Lima and will report to the Legislature in favor of same.

Providence, R. I.—It is stated that all bids recently received for erecting the 2d Ward Fire Station have been rejected.

Deadwood, S. D.—Court house bonds amounting to $25,000, it is stated, have been sold.

Memphis, Tenn.—It is stated that Hale & Rogers, of Chicago, Ill., have about completed plans for the court house, and that bids for the construction will soon be asked by the Court House Comn.

Hemphill, Tex.—J. A. Watson, County Clk., writes that it is proposed to erect a court house at a cost of $30,000.

Wausau, Wis.—It is stated that the Bd. of Pub. Wks. has decided upon plans for a buff brick and Bedford stone city hall which is to be erected at a cost of $50,000.

Hamilton, Ont.—The Finance Com., it is stated, has decided to recommend that a bylaw be submitted to the people in Jan. to vote on the question of issuing $35,000 bonds to complete the new wing at the hospital.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—The Doster-Northington Drug Co., it is stated, has announced that they will erect a 4-story brick building on First Ave. and 21st St.

Hopson & Son, wholesale grocers of Morris Ave., it is stated, have secured a site on 16th St. and Ave. A, and are having plans prepared for a warehouse to cost about $30,000.

**San Francisco, Cal.*—Ira W. Coburn, it is reported, has secured the contract to erect a 2-story building for the Golden Gate Commandery, Knights Templar, at about $92,000.

Denver, Colo.—It is stated that the Denver Gas & Electric Co. is contemplating the erection of a 6-story building, to cost about $250,000.

Denver, Colo.—The owners of the Albany Hotel, it is reported, are contemplating the erection of an addition to cost $150,000. Wm. Mayer Hotel Co., Mgrs.

Bridgeport, Conn.—The Connecticut Ry. & Lighting Co. (J. E. Sewell, Gen. Mgr., Bridgeport), it is reported is perfecting plans for a car barn to take the place of the 3 now in use in Bridgeport. It is stated that the company proposes spending about $100,000.

Athens, Ga.—See "Railroads."

Chicago, Ill.—The Beach Amusement Co. (H. E. Rice, Gen. Mgr.) it is stated, intends making various improvements, including the erection of a cafe to cost $75,000, and a theatre to cost $25,000.

The Chicago Land & Constr. Co. is having plans prepared for a department store to be built at Logan Sq., to cost $70,000.

Hill & Woltersdorf, 70 La Salle St., will have charge of the improvements to be made in the 5-story store and flat building to be built at 2273 Evanston Ave., for Matthew Zakowski. Cost, $25,000.

The Chicago Automobile Club, it is stated, has appointed a Bldg. Com., of which Ira M. Cobe is Chmn., who will have charge of the new club house which it is proposed erecting at a cost of $120,000.

The M. H. Tichenor Co., it is stated, is about to construct a model barn and sales stable southwest of the stock yards. It will extend from Pauline to Honora Sts. and from 38th to 59th Sts. Plans have been completed by Marshall & Fox for a 2 story, 300 x 150-ft. building, to cost about $125,000.

J. K. Sebree, proprietor of the Saratoga Hotel, secured a lease to the property in Madison St., adjoining the Morrison, on which he expects to erect a $1,000,000 hotel. The hotel will be 12 stories in height and of fireproof construction.

The Knights of Columbus, it is stated, are contemplating the erection of a club house, to cost about $1,000,000, and to be either 10 or 12 stories high. Jerome J. Crowley, Secy. Central Chapter, may be able to give further information.

John Ahlschlager has prepared plans for a mercantile building, to be built at 1533 Michigan Ave., for the Chicago Cold Storage Warehouse Co., 1532 Indiana Ave. It will be 5-story and is estimated to cost $100,000.

Alton, Ill.—The Knights of Pythias, it is stated, are contemplating the erection of a home here, to cost about $250,000.

Duquoin, Ill.—The Duquoin Opera House Co. (W. R. Hays, Pres.), it is reported, has been incorporated with a capital of $25,000 and proposes making improvements to a building for opera house purposes, the cost to be about $30,000.

**Springfield, Ill.*—W. J. McAlpine, it is reported, has secured the contract to erect an 8-story brick business building at Monroe Ave. and 6th St., for Mrs. Ferguson, the cost to be about $100,000.

Davis, Ind. Ter.—It is reported that plans are being prepared for a 3-story opera house, to be erected on Main St., at a cost of $25,000.

**Davenport, Ia.*—The general contract for the 5-story building to be erected on W. 2d St. for Louis Hanssen's Sons, it is stated, has been secured by Henry Mecklenberg, 650 W. 3rd St. The total cost of the building is to be about $30,000. G. A. Hanssen, 34 Schmidt Bldg., is the archt.

Sioux City, Ia.—The members of the Y. M. C. A., it is stated, are contemplating the erection of a new building to cost $55,000.

Topeka, Kan.—It is reported that the officials of the Atchison, Topeka & Santa Fe R. R. (W. B. Storey, Ch. Engr., Topeka) intend erecting a $40,000 addition to its office buildings in this city.

Wichita, Kan.—It is reported that the officials of the Atchison, Topeka & Santa Fe R. R. (W. B. Storey, Ch. Engr., Topeka) will erect a depot here estimated to cost $55,000.

Atchison, Kan.—The Directors of the Elks Lodge, it is stated, have adopted the plans prepared by W. H. Sayler, of Kansas City, Mo., for the brick club house which they propose erecting in the spring at a cost of $12,000.

Louisville, Ky.—See "Power Plants, Gas and Electricity."

Lexington, Ky.—The stockholders of the Phoenix Hotel, it is reported, have decided to increase their capital to $1,000,000 and intend erecting a 4-story addition to the present building.

Louisville, Ky.—The erection of a 6-story hotel on 5th and Walnut Sts. is reported under consideration. Judge McGee, owner of the site, is reported interested.

New Orelans, La.—Pres. W. Mason Smith, of the Audubon Hotel Co., it is stated, has announced that plans are being prepared for the Audubon Hotel, which is to be erected on Camp St., the cost of the building alone to be about $1,000,000.

The Bldg. Com. of the Young Men's Gymnastic Club, it is stated, has adopted plans for a 6-story club house which it is proposed erecting at a cost of about $120,000.

**Baton Rouge, La.*—C. D. Stewart, it is stated, has secured the contract to erect the 3-story brick Masonic Temple at about $28,950.

Baltimore, Md.—It is stated that preliminary plans have been prepared by Parker & Thomas, 612 N. Calvert St., for a building to be erected on Light St. in connection with the present building of the International Trust Co.

The erection of a $300,000 Y. M. C. A. Bldg. is reported under consideration.

**Worcester, Mass.*—E. J. Cross, 82 Foster St., it is stated, has secured the contract to erect a main building and power house for the Worcester Cold Storage & Warehouse Co., the cost to be $70,000.

Lowell, Mass.—Klaw & Erlanger, it is stated, intend erecting a theatre on the site of the Runnels & Flint Bldg., Bridge St. and Merrimac Sq., the cost to be about $100,000.

Fall River, Mass.—A. N. Lincoln, of the firm of Lincoln & Hood, will erect a 4-story store and apartment house on Ashton and Pleasant St.; cost, $20,000.

Edw. Mooney, 1831 Pleasant St., is reported interested in the erection of a 2-story building, 50x130 ft., to be erected on Thomas St., to be used as a skating rink.

Marquette, Mich.—The erection of a Y. M. C. A. bldg., to cost about $40,000, is reported under consideration.

Ludington, Mich.—Architect Mason, of Detroit, is reported to be preparing plans for a brick building, to be erected here.

Detroit, Mich.—The members of the Polish-American Club, it is stated, are contemplating the erection of a $25,000 club house.

Duluth, Minn.—It is stated that the Bldg. Com. (John Miller, Chmn.) has been authorized to secure an archt. to prepare plans for the Y. M. C. A. bldg. Probable cost, $125,000.

Rushford, Minn.—The Masonic Fraternity of this city, it is stated, has decided to erect next spring a building to cost $10,000.

Columbus, Miss.—The Directors of the Columbus Insurance & Banking Co., it is stated, have decided to erect a 6-story brick and stone building, to cost about $50,000.

Billings, Mont.—The owners of the Northern Hotel, it is stated, are having plans prepared for improvements to be made to the hotel at a cost of about $125,000.

Omaha, Neb.—It is stated that a company, to be known as the Cosmopolitan Hotel Co., is about to be formed for the purpose of erecting a hotel here to cost, not including furnishings, about $400,000.

Elizabeth, N. J.—The members of the Young Men's Father Mathew Temperance Society. it is stated, contemplate erecting in the near future a $30,000 club house.

Newark, N. J.—It is stated that plans have been filed for a 3-story stable and storehouse, to be erected for the Borden Condensed Milk Co., at 4th and Mt. Pleasant Aves., the cost to be about $28,000. G. C. Chamberlain, of New York, N. Y., is the Archt.

Brooklyn, N. Y.—The Bd. of Directors of the Brooklyn Club, it is stated, has adopted plans prepared by R. L. Daus, 26 Court St., for an addition which it is proposed erecting to the club house, the cost to be about $25,000.

New York, N. Y.—Plans have been filed for a 9-story club house, to be erected at 18 to 22 W. 40th St., for the New York Club, at a cost of $300,000. Henry J. Hardenbergh, Archt., 1 W. 34th St.

Gloversville, N. Y.—The members of the Eccentric Club, it is stated, are contemplating the erection of a club house to cost about $25,000.

**Cleveland, O.*—The Cleveland Trust Co., it is stated, has awarded to John Gill & Sons, Williamson Bldg., the contract to erect a 3-story steel and granite bank building on Euclid Ave. and a 5-story stone and steel mercantile building on Erie St., the aggregate cost of the 2 buildings to be $700,000.

Springfield, O.—Linthwaite & Holbrook, of Columbus, it is reported, have prepared plans for an 8-story office building and theatre to be erected here by the Fairfax Co., at a cost of $225,000.

North Bend, Ore.—Wm. Thomas, it is reported, intends erecting a $30,000 hotel here.

Philadelphia, Pa.—A building permit, it is stated, has been granted to C. J. Matthews, owner, to erect a 5-story reinforced concrete addition to building at Bodine and Willow Sts., at a cost of $20,000.

*A building permit has been granted to Arthur Scranton, 641 Heed Bldg., to make alterations, etc., to the building at 48th St. and Baltimore Ave., the cost to be $20,000.

The John B. Stetson Co., it is stated, will erect a 2-story fireproof addition, 100x200 ft., to its building on Cadwallader St., to cost about $100,000.

Allentown, Pa.—It is reported that John D. Mishler of Reading is contemplating the erection of a theatre on the old Academy of Music site in this city, the cost to be about $70,000.

**Pittsburg, Pa.*—It is stated that Broido & Baumgartner. of Pittsburg, have secured the contract to erect the hall and lodge building for Montefiore Hall Assoc., I. O. O. F., on 5th Ave., at a cost of about $25,000.

F. J. Osterling, Times Bldg., it is stated, has been engaged to prepare plans for the 15-story building which the Commonwealth Trust Co. intends erecting at a cost of about $500,000.

Hanover, Pa.—Herman Miller, Crozer Bldg., Philadelphia, it is stated, has been selected to prepare plans for a $100,000 bank building to be erected for the Hanover (Pa.) Saving Fund Society.

**Charleston, S. C.*—The following are reported to be the bids opened Nov. 22 for erecting the union station at Charleston: Grant Wilkins, Atlanta, Ga., $152,000 (awarded contract); Geo. B. Long, $154,582; Moise DeLeon, $155,400; Simons-Mayrant Co., $158,700; H. C. Morrison, $163,520; McKenzie, $163,880; W. J. Wilkins, $164,254; King Lumber Co., $169,970; H. T. Zacharias, $173,656; Jordan, $181,466.

Memphis, Tenn.—It is stated that a site has been selected at Dunlap and Madison Sts., and as soon as plans have been prepared bids for the erection of the club house for the Young Men's Hebrew Assoc. will be asked. Probable cost, $50,000. Henry D. Bauer, Chmn. Bldg. Com.

Alsup & Wood, Randolph Bldg., it is stated, have completed plans and bids for the erection of the Goodwyn Inst., at Madison and 3rd Sts., will soon be asked. It is to be of steel fireproof construction, brick and stone, and is to cost about $260,000.

F. Blomberg, it is stated, intends erecting an automobile garage on Madison St., to cost about $25,000.

Chattanooga, Tenn.—J. B. Pound, it is reported, is interested in the erection of a hotel here to cost about $300,000.

The Chattanooga Bldg. Co., it is stated, has appointed a committee to look into the matter of erecting an 8 or 9 story office building here.

Jackson, Tenn.—The citizens, it is stated, are contemplating the erection of a Y. M. C. A. bldg., to cost about $25,000.

Beaumont, Tex.—Bids will be received until Dec. 15 by John B. Goodhue, Beaumont, for furnishing material and erecting a 4-story hotel, plans for which may be had from the archt., L. S. Green, Houston, on a deposit of $25.

Norfolk, Va.—It is stated that the Bd. of Governors of the Jamestown Exposition will soon ask bids for erecting several buildings, including the administration building.

It is reported that the Hofheimer Bros. are preparing to erect an addition to the Fairfax Hotel at a cost of $50,000.

Walla Walla, Wash.—The Kellough Clothing Co., it is stated, intends in the spring, erecting a 4-story department store at Adler and 3d Sts.

Bellingham, Wash.—The members of the Bellingham Athletic Assoc., it is stated, are contemplating the erection of a club house, to cost about $50,000.

Seattle, Wash.—It is reported that Winfield Diller, 109 University St., will erect an addition to the Diller Hotel, to cost $20,000. Robertson & Donnellan are the Archts.

Spokane, Wash.—Thos. Greenought, it is reported, will in the spring erect a $750,000 hotel on Washington St.

The Oregon R. R. & Navigation Co. (G. W. Boschke, Ch. Engr., Portland, Ore.), it is reported, will erect a $50,000 passenger station between Howard and Washington Sts.

Kenosha, Wis.—It is reported that the Chicago & Milwaukee Electric Ry. Co. (S. A. Jennings, Ch. Engr., Highwood, Ill.) intends erecting a $25,000 station in this city.

Racine, Wis.—Geo. Johnston, of St. Louis, Mo., it is stated, has made a proposition to this city to erect a $60,000 theatre.

La Crosse, Wis.—The erection of an auditorium to cost about $100,000 is reported under consideration.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Fivepoints, Ala.—The congregation of the Methodist Church is said to be contemplating the erection of a new edifice at a cost of $50,000, and has appointed a Bldg. Com., of which R. S. Munger is Pres., which will select an archt. to prepare plans for the structure.

Hot Springs, Ark.—The congregation of the First Baptist Church, it is stated, intends erecting an edifice at Court and Exchange Sts., to cost $60,000. Rev. W. T. Amis, pastor.

Los Angeles, Cal.—The congregation of the First Presbyterian Church, it is stated, has accepted the plans of Thornton Fitzhugh, Laughlin Bldg., for a $40,000 edifice.

Washington, D. C.—It is reported that plans have been prepared for a 4-story apartment house, estimated to cost $50,000. Bates Warren is reported interested.

Chicago, Ill.—L. M. Mitchell, 145 La Salle St., is preparing plans for an apartment building to be built at 61st St. and Drexel Ave., for William Lear, 61st St. and Drexel Ave., who, it is stated, will take figures. It will be 3-story, 84x202 ft., have pressed brick and stone fronts and cost $100,000.

Geo. C. Purssel has prepared plans for an apartment building to be built at Ohio St. and Kedzie Ave. It will cost $40,000.

Wilmore Alloway, Marquette Bldg., has prepared plans for an apartment building to be built on Calumet Ave., near 54th St., for Mrs. E. M. Phillips, 4622 Langley Ave., who, it is stated, will take figures. It will cost $22,000.

H. J. McMuller, 1618 W. 12th St., has prepared plans for an apartment building to be built on Spaulding Ave., near 15th St., for Mrs. P. Brodie. It will cost $35,000.

Henry K. Holsman, 153 La Salle St., reports that he has prepared plans for an apartment building to be built at 72d St. and Harvard Ave., for W. H. Bell. It is estimated to cost $25,000.

**Storm Lake, Ia.*—Chas. Wesson, it is reported, has secured the contract to erect the M. E. Church at about $17,150.

Des Moines; Ia.—It is stated that a $50,000 apartment house is to be erected at Locust and 10th Sts. by J. M. Graham.

** Items marked thus give the names of parties awarded contracts*

**Baltimore, Md.*—A. K. Boteler, 1323 Myrtle Ave., it is stated, has secured the contract to erect the Walbrook Presbyterian Church at Walbrook Ave. and 10th St., to cost about $20,000. Mottu & White, 402 St. Paul St., are the archts.

Worcester, Mass.—The congregation of the Swedish-Finnish Lutheran Church, it is reported, has appointed a Bldg. Com. who will engage an architect to prepare plans for a brick edifice which they propose erecting at Belmont and Carbon Sts., at a cost of about $20,000.

Big Rapids, Mich.—The congregation of the M. E. Church, it is stated, has decided to replace the present edifice with a brick structure to cost $15,000.

Huntington, L. I., N. Y.—The Bldg. Com. of St. John's Episcopal Church, it is stated, has adopted plans for a stone edifice to be erected on Main St., at a cost of $20,000.

Pittsburg, Pa.—The congregation of the Emory M. E. Church, it is reported, intends erecting a new edifice in the spring, to cost about $100,000. Rev. R. W. Weddersoon, Pastor.

Knoxville, Tenn.—A building permit has been granted to L. A. Galyon, 205 N. Florida St., to erect a 3-story apartment house at Oxford Pl. and Locust St., to cost $16,000.

Sherman, Tex.—The Travis Street M. E. Church, it is stated, has decided to erect an edifice at a cost of $30,000.

Spokane, Wash.—The Congregation of the First Presbyterian Church, it is stated, has authorized the Bd. of Trus. to proceed with the erection of a new edifice, the cost not to exceed $65,000.

Milwaukee, Wis.—Archibald Hood, it is reported, will erect a $75,000 apartment house on 22d St. and Grant Ave.

SCHOOLS.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—The following are reported to be lowest bids received Nov. 22 for erecting 3 schools: Washington Grammar School, P. J. Lynch, $114,925; Laguna Honda School, Wm. Newson, $55,000, and Sunnyside School, Petterson & Persson, $61,000.

Riverside, Cal.—Bids will be received until Jan. 2 by the Comr. Indian Affairs, Washington, D. C. (C. F. Larrabee, Acting Comr.) for furnishing material and constructing a brick industrial building, with plumbing, electric light and water and sewer connections. For further information apply to Harwood Hall, Supt., Riverside.

Savannah, Ga.—It is stated that bids will soon be asked by the School Bd. for erecting the Barnard St. school, a 13-room building, according to plans prepared by G. L. Norman, of Atlanta. It is also stated that bids will soon be asked for erecting the manual training shop for the high school pupils.

The Trus. of Chatham Academy and the Bd. of Educ., it is reported, will soon select an architect to prepare plans for the high school, which they propose erecting, jointly, at a cost of about $60,000.

Cambridge, Ill.—P. T. Burrows, of Davenport, Ia., it is reported, is the architect whose plans have been approved for the $35,000 school which is to be erected here. It is reported that bids for the construction will soon be asked by the School Bd.

Chicago, Ill.—The Council Com. on Schools, it is stated, has decided to recommend the erection of 3 new schools, at a cost of about $175,000 each, and the erection of 2 school additions, the aggregate cost to be about $775,000.

Franklin, Ind.—It is reported that bids will soon be asked by the Trus. of Franklin College for the erection of a dormitory, gymnasium and a science hall, the aggregate cost to be $100,000. Dr. Bryan, Pres.

Sioux City, Ia.—The Bd. of Educ., it is stated, has adopted plans for the high school which is to be erected at a cost of $40,000, and it is stated that the contract for the foundation is to be let immediately.

Des Moines, Ia.—The Central Church of Christ, it is reported, intends erecting at 9th and Pleasant Sts., next spring, an institutional school to cost $20,000.

**Emporia, Kan.*—The Morse Contr. Co., of Topeka, it is stated, has secured the contract for the erection of a science building at the Emporia Normal School at $39,149. Other bids received are reported to have been as follows: Henry Bennett, $42,338; F. M. Spencer, $39,945; Cuthbert & Sargent, $41,150.

Hutchinson, Kan.—The Bd. of Educ. is said to be considering the erection of a high school, to cost about $50,000.

Amherst, Mass.—The barn at the State Agricultural College at Amherst, which cost $40,000 to erect, it is reported, has been destroyed by fire; also the electric light plant and the dairy school.

Medford, Mass.—The Trus. of Tufts College contemplate building a central heating station to heat the new Carnegie Library now being erected and adjacent buildings.

Jackson, Mich.—Claire Allen, of Jackson, has prepared plans for a high school, to cost about $105,000. Money has not yet been voted.

Duluth, Minn.—Plans have been approved, according to reports, as prepared by German & Lignell, Torry Bldg., for a 10-room school which is to be erected on 6th St. at a cost of $50,000.

**Omaha, Neb.*—P. J. Creedon & Sons, 2120 California St., it is reported, have secured the contract to erect a dormitory for Creighton College at 25th and California Sts., at a cost of about $45,000.

**Convent Station, N. J.*—It is stated that contracts have been awarded as follows for erecting a dormitory at St. Elizabeth's College at Convent Station: Total cost of the building, it is stated, will be about $102,000: John V. Corbett, Madison, mason work; Ralph Dalgalish, Morristown, carpenter work and roofing; Albert Smith's Sons, Newark, structural iron; A. B. Barr, Yonkers, N. Y., heating; Theodore Geiser & Sons, Newark, plumbing; Charles Stopper, Newark, painting; James A. Christie, Newark, sewer and drain; Ding & Teucher, Newark, metal work; New Jersey Engineering Co., Morristown, electrical work, and Driggs & Co., Newark, tiling and marble work. Eugene McMurray, of Newark, is the Archt.

Gloversville, N. Y.—The Bd. of Educ., it is stated, has rejected all bids recently received for the $100,000 high school, and it is reported will soon ask new bids.

New York, N. Y.—Bids will be received by the Bd. Trus. of the College of the City of New York (Edw. M. Shepard, Chmn.) until Dec. 7 at the office of the Board, Lexington Ave. and 23d St., for the temporary heating of the Sub-Freshman Bldg., in the course of erection on St. Nicholas Terrace.

Bids will received until Dec. 11 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for the general construction of additions to and alterations in school No. 34, and for sanitary work and gas fitting in school No. 42, both in the Boro. of Bronx.

Buffalo, N. Y.—Bids will be received until Dec. 7 by the Dept. Pub. Wks. (Francis G. Ward, Comr.) for erecting a 4-room brick addition to the present school in Dist. No. 2. Bids to be submitted separately on the following: Masonry, cut stone, iron work, etc.; roofing, etc.; ventilating and heating, etc.; plumbing, gas fitting, etc.

New York, N. Y.—Plans have been filed for 2 brick schools to be erected at Victor St. and Morris Park Ave. for the City of New York, at a cost of $95,000. C. B. J. Snyder, Archt., 59th St. and Park Ave.

**New Brighton, S. I., N. Y.*—Contracts for sanitary work and gasfitting of additions to and alterations in Schools Nos. 16 and 23, in Richmond Boro. (bids opened Nov. 27) have been awarded to Jas. Harley, 288 Flatbush Ave., Brooklyn, N. Y., at $7,737 and $5,838 respectively.

Struthers, O.—Bids will be received until Dec. 18 at the office of A. B. Stough, Clk. Bd. Educ., for $35,000 bonds for erecting a high school.

Oberlin, O.—The Trus. of Oberlin College, it is stated, have decided to erect an additional story to the women's dormitory. It is reported that plans are being prepared for the Finney Memorial Chapel, to be erected at the college. The plans for the $125,000 Carnegie Library, it is stated, have been completed, but nothing further will be done in this matter until the $100,000 fund for library endowment is completed.

Dennison, O.—The issuing of $50,000 bonds, the proceeds to be used to erect 3 schools, is reported under consideration.

**Miamisburg, O.*—John Arpp, of Middletown, it is reported, has secured the contract for the ventilating and heating the school at $7,279, and Plocher & Son, of Miamisburg, the contract for the plumbing at $2,212.

Toledo, O.—Bids will be received until Dec. 22 by the Bd. Educ., Toledo School Dist. (G. Otto Haubold, Clk.) for furnishing material and erecting a 5-room addition to the Ontario School; also a 6-room addition to the Raymer School, including plumbing and heating. Bids on material and labor to be submitted separately.

Pawhuska, Okla. Ter.—Bids will be received until Jan. 4 by the Comr. Indian Affairs, Washington, D. C. (C. F. Larrabee, Acting Comr.) for constructing and completing a stone barn and laundry, with plumbing, steam heat and piping for gasoline gas, at the Osage Agency Boarding School. For further information apply to Frank Frantz, U. S. Indian Agent, Pawhuska.

Abington, Pa.—The School Bd., it is stated, is about to apply to the County Court for permission to issue $30,000 bonds to erect a school in Abington Township.

**Providence, R. I.*—The following are reported to be the bids received Nov. 20 for erecting an addition to the Technical High School: David J. Barry, 64 E. Manning St., $108,987 (awarded contract); L. J. Pierce Bldg. Co., $115,176; Horton & Hemenway, $125,447; J. W. Bishop Co., $138,770; William Gilbane & Bro., $143,000.

Memphis, Tenn.—A charter has been granted to the College of Physicians and Surgeons of Memphis, with a capital of $40,000. The company proposes in the spring erecting a $60,000 building and establishing a medical and surgical college.

**Port Arthur, Tex.*—The School Bd., it is reported, has awarded contracts as follows for erecting the manual school: general contract to J. M. Brown, of Houston, at $52,000, and also wiring and plumbing to the same party at an additional $3,000; ventilating and heating to Lewis & Kitchen, of Kansas City, Mo., at $10,400, and automatic regulation to the Johnson Serviss Co., of Milwaukee, Wis., at $2,200.

Madison, Wis.—See "Power Plants, Gas and Electricity."

Monroe, Wis.—J. L. Sherron, Secy. School Bd., writes that Claude & Stark, of Madison, are preparing plans for a school to be erected here, at a cost of $40,000. Contracts for construction will probably be let in January.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Chicago, Ill.—The following are reported to have been the bids recently received for the collection and disposal of garbage of the entire city by the reduction process for one year: John Dowdle, $794,000, and Darling & Co., $743,000.

Detroit, Mich.—Bids will be received until Dec. 11 by F. A. Blades, City Comn., for a garbage disposal plant, either incineration or reduction, having a maximum capacity of 200 tons per day and capable of disposing of the garbage of the city in a strictly sanitary manner. Each bidder will be required to accompany his proposal with a set of drawings, plans and a detailed statement showing the methods by which the plant therein offered will dispose of said garbage.

**New York, N. Y.*—The Bd. of Estimate on Nov. 24 approved the contract with the New York Sanitary Utilization Co., for final disposition of garbage in Manhattan for $148,000 per year.

Rochester, N. Y.—City Engr. Fisher is reported to be preparing plans for a municipal garbage plant which will probably be constructed next year.

Ottawa, Ont.—N. J. Kerr, City Engr., writes that bids are wanted Dec. 7 for the construction of a garbage disposal plant; probable cost, $15,000.

NEW INDUSTRIAL PLANTS.

Notes Arranged Alphabetically by States.

Pratt & Whitney Co., Hartford, Conn., have begun work on a new foundry building, to measure 210 x 116 ft.

The Swift River Paper Co., recently organized at Springfield, Mass., will operate a plant at West Ware, it is locally reported.

The John B. Stetson Co., Philadelphia, Pa., will erect a $100,000 addition to its present plant, according to local newspaper reports.

C. Heidt & Sons, Jersey City, N. J., are having plans prepared for a large addition to their plant, according to local newspaper reports.

The Morley Twine & Machinery Co., Sioux City, Ia., will shortly begin the erection of a new plant, according to local newspaper reports.

The Waterbury Chemical Co., Des Moines, Ia., is preparing plans for a new building, to cost $30,000, according to local newspaper reports.

Great Western Pump Mfg. Co., Spring City, Utah, will erect a new building, to measure 40 x 80 ft. Power plant of 10-hp. will be required.

The Pullman Co., Chicago, Ill., is reported by local newspapers as contemplating the expenditure of $5,000,000 in increasing the capacity of its plant at Pullman.

A company is being organized at Everett, Wash., according to local reports, and will erect a $1,000,000 paper mill at Sunset Falls, where a site has been secured.

The Seng Co., Chicago, Ill., mfr. of hardware specialties, is erecting a large addition to its plant. Additional power plant will be purchased sometime in the future.

The Sherwin-Williams Paint Co., Newark, N. J., will shortly begin the construction of an extensive addition to its present plant, according to local newspaper reports.

The Reynolds Wagon Co., Kalamazoo, Mich., has prepared plans for a new factory building, 200 x 90 ft., to be constructed of concrete blocks, according to local newspaper reports.

Horatio Fire & Building Brick Mfg. Co., Horatio, Ark., is building a new plant, and is in the market for a complete outfit having a capacity of 20 to 40 thousand brick per day.

The R. Neumann Hardware Co., Newark, N. J., has begun the erection of an addition to its manufacturing plant, according to local reports. The new building will measure 50 x 100 ft.

The Troup Co., Lagrange, Ga., mfrs. of fertilizers, will erect a new plant consisting of chemical building, 40 x 260 ft., 3 stories, and mill building, 80 x 400 ft. This company is in the market for a power plant of 150-hp. capacity.

Peters Fire Brick Co., Ironton, O., is rebuilding its recently burned plant, the new plant consisting of three buildings, 40 x 124 ft., 40 x 100 ft. and 40 x 80 ft. respectively. This company is in the market for a second-hand boiler, 16 x 60, 44 flues.

A new plant is being erected at Guthrie, Okla., by the Corrugated Steel Culvert Co., which, according to local newspaper reports, has recently been organized for the manufacture of corrugated steel culverts, sewer pipe, well curbs, arches, steel roofs, etc. Mr. E. M. Pyle is manager of the new company.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Washington, D. C.—Bids will be received until Dec. 26 at the Bureau Supplies and Accounts, Navy Dept., Washington, to furnish at the Navy Yards, Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; League Island, Pa., and Norfolk, Va., a quantity of machine tools, etc., as follows: Schedule 256—Exhaust fans. Schedule 257—Screw machine, planer, cutting-off machine, engine lathe, etc. Schedule 258—Metal-sawing machine, windlasses. Schedule 259—Air drills, converting traveling crane. Applications for proposals should designate the schedules desired by number. H. T. B. Harris, Paymaster Gen., U. S. N.

Washington, D. C.—See "Power Plants, Gas and Electricity."

New Orleans, La.—The only bid received and opened Nov. 25 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for concrete drainage canals, curbing and sidewalks of the naval station, New Orleans, La. (Specification No. 1,469) was submitted by Wm. H. Douglas, 718 Poydras St., New Orleans. He bid $24,960 for work complete, according to plans, and $9 per lin. ft. to be deducted from small drainage canals.

The following are reported to be the bids recently received by W. J. Hardee, City Engr., for the installation of subsurface drains to eliminate the open box culvert in Prytania St.: W. H. Douglass, $16,427; Jos. A. Craven & Co., $16,318, and Irwin Bros., $15,887.

Philadelphia, Pa.—The following are the bids opened on Nov. 24 by the Dept. Pub. Wks. for deepening and improving channel of Delaware River bet. Philadelphia and Delaware Bay: (*a*) American Dredging Co., 510 Mariner & Merchant Bldg., (*b*) Atlantic, Gulf & Pacific Dredging Co., Park Row Bldg., New York, N. Y., (*c*) P. Sanford Ross, Inc., Jersey City, N. J., (*d*) N. American Dredging Co., by Claude Cummins, Jacksonville, Fla., (*e*) Morris & Cumings Dredging Co., 17 State St., New York, N. Y.

	a	*b*	*c*	*d*	*e*
1,120,000 cu. yds. mud, sand, etc. (unclassified), Sec. 6-A..........	$.155	$.16	$.17	$.1489	$.20
1,121,000 cu. yds. mud, sand, etc., (unclassified) Sec. 6-B..........	.165	.17	.18	..	.20
1,048,000 cu. yds. mud, sand, etc. (unclassified), Sec. 7............	.18	.18	.20	.1489	.20
1,456,000 cu. yds. mud, sand, etc. (unclassified), Sec. 8............	.187	.19	.20	..	.24
846,000 cu. yds. mud, sand, etc. (unclassified), Sec. 9..............	.185	.19	.20	..	.24
Measurement	scow	scow	scow	place	scow
Time of completion....................................	17 mos.	Dec. 31, '07	24 mos.	14 mos.	24 mos.

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* *Items marked thus give the names of parties awarded contracts.*

**Boston, Mass.*—The Bd. of Harbor and Land Comrs. is reported to have awarded to the Bay State Dredging Co., 19 High St., the contract for dredging Ft. Point Channel, at 29 cts. per cu. yd.

Manistee, Mich.—Manistee County has in contemplation for the near future a considerable amount of drain construction. E. W. Muenscher, Engr. County Drain Comrs.

**Port Huron, Mich.*—The contract for completing the Lake Huron-Black River canal (bids opened Nov. 3) is stated to have been awarded to Graves & Stevens, of Indianapolis, for $73,000.

**Duluth, Minn.*—The Barnett & Record Co., of Minneapolis, is reported to have secured the contract for the construction of No. 4 ore dock for the Duluth, Missabe & Northern R. R. Co. (H. L. Dresser, Ch. Engr., Duluth) for about $700,000. The dock and approaches will cost about $1,000,000. The balance of the expenditure will, it is stated, be made by the R. R. Co. direct.

**St. Louis, Mo.*—Lieut. Col. F. von Schrader, Deputy Q. M., U. S. A., St. Louis, writes that the Hooker Steam Pump Co., 218 Granite Blk., St. Louis, has secured the contract for furnishing boilers at the following posts: A 50-hp. at Ft. Brown, Tex., a 30-hp. at Ft. Huachuca, Ariz., a 40-hp. at Ft. Ringgold and a 40-hp. at Ft. Wingate, N. M. H. P. Waterman, of Denver, Colo., secured the contract for a compound pump for Ft. Logan, Colo., all bids opened on Nov. 7.

New York, N. Y.—The following are the bids opened on Nov. 22 by Col. W. R. Livermore, Corps Engrs., U. S. A., for dredging: Keyport Harbor, Atlantic Dredging Co., 15 Whitehall St., 29 cts. per cu. yd.; Woodbridge Creek, J. Marvin Briggs, 17 Battery Pl., 48 cts.; Shoal Harbor and Compton Creek, Ambrose C. Driscoll, 309 W. Genesee St., Syracuse, 78 cts., and same company for dredging South River, 42 cts.

The following are the bids opened on Nov. 28 by Col. W. P. Livermore, Corps Engrs., U. S. A., Army Bldg., for dredging in Shrewsbury River, N. J.: J. Marvin Briggs, 17 Battery Pl., 38 cts., and Michael Flannery, 120 Liberty St., 28 cts.

Buffalo, N. Y.—Bids will be received by Col. H. M. Adams, Corps Engrs., U. S. A., until Jan. 15, for excavation in Black Rock Harbor, as advertised in The Engineering Record.

Tarrytown, N. Y.—The following two bids were opened on Nov. 27 by Col. W. P. Livermore, Corps Engrs., U. S. A., for dredging in Tarrytown Harbor, N. Y.: Columbia Dredging Co., 64 Broad St., N. Y. City, 15.7 cts. per cu. yd., 60,509 cu. yds. to be dredged, and the W. H. Beard Dredging Co., 21 State St., N. Y. City, 21.5 cts. per cu. yd., 44,186 cu. yds. to be dredged.

Troy, N. Y.—Bids will be received until Dec. 5 by the Bd. Contract and Supply (Jas. M. Riley, Clk.) for furnishing and constructing about 13,000 lin. ft. of wooden fencing and about 460 lin. ft. iron pipe guard rail along the new highway around the Tomhannock Reservoir, in the Town of Pittstown, and about 25 miles of wire fencing.

Brooklyn, N. Y.—The Bd. of Estimate on Nov. 24 adopted a resolution authorizing the Corporation Counsel to start condemnation proceedings at once, looking to the laying out of the park at Owl's Head on the Shore Road, Brooklyn Boro.; it also ordered an issue of corporate stock of $1,875,000 to improve and complete the Bay Ridge Parkway and Shore Road and 1st Ave. to Ft. Hamilton, Brooklyn, and an appropriation of $264,000 for turning 7th Ave. into a boulevard from 110th St. to 153d St., Manhattan Boro.

*The contract for constructing a purification plant for the Gowanus Canal (bids opened Nov. 15 by Martin W. Littleton, Pres. Brooklyn Boro.) is reported to have been awarded to the John Pierce Co., 277 B'way, N. Y. City, for $703,000.

The Commercial Constr. Co., 1 Madison Ave., N. Y. City, has secured the contract for installing fire alarm telegraph system in 16 schools in Brooklyn Boro. (bids opened Nov. 27) for a total of $8,794.

New Brighton, S. I., N. Y.—Bids will be received until Dec. 12 by Geo. Cromwell, Pres. Richmond Boro., at New Brighton, for furnishing and delivering broken stone and screenings in Stone Dists. Nos. 1 and 2, requiring in each, according to the Engineer's estimate, 400 cu. yds. 1½-in. stone, 800 cu. yds. ¾-in. stone and 300 cu. yds. screenings.

Columbus, O.—Chief Engineer Perkins, of the State Bd. of Pub. Wks., is reported to have recommended replacing the old wooden dam now maintained in Sciota River by the State for the Columbus feeder, with a new folding dam, which will furnish slack water as far up the river as Olentangy Park.

Philadelphia, Pa.—City Council Survey Committee, with Chief Webster, of the Bureau of Surveys, is reported to have inspected property along the alternative line for the Parkway, bet. Logan Square and Fairmount Park, as suggested by Mayor Weaver. It is reported that the parkway could be constructed according to the Mayor's plan at $2,000,000.

Houston, Tex.—Bids will be received until Dec. 12 by John B. Ashe, Co. Aud., Houston, for constructing a drainage ditch and wooden trestle bridge across Clear Creek, connecting Galveston and Houston Counties on Friendswood Road, also for drainage ditch and repairs of the Harrisburg Road from the south side of Brays Bayou to the north side of the Galveston, Harrisonburg and San Antonio R. R. track.

Beaumont, Tex.—Bids will be received by Kendrick-Hammond-Quigley Constr. Co., Beaumont, for about 300 miles of grading between Baton Rouge, La., and Houston, Tex., 1 year's work. They will let it in quantities to suit any sized outfit. Free transportation on outfit from any point on the Kansas City Southern R. R. and over the main line of the St. Louis, Iron Mountain and Southern R. R.

Ft. Monroe, Va.—Bids will be received until Dec. 29 by Capt. E. Eveleth Winslow, Corps Engrs., U. S. A., Norfolk, Va., for constructing a wharf at Ft. Monroe.

Richmond, Va.—Bids will be received at the U. S. Engineer Office, 28 N. 9th St., until Dec. 22 for dredging, removing rock, and constructing and repairing jetties in James River, as advertised in The Engineering Record.

La Crosse, Wis.—City Engr. Walter S. Woods, estimates the cost of constructing a causeway, from north end of Oakland St. to south end of Loomis St., across the Marsh between the north and south sides, at $18,000. With a macadamized roadbed it is estimated to cost $33,708.

Panama.—Bids will be received by the Isthmian Canal Comn., Washington, D. C., until Dec. 18 for steam pumps, plows, eveners, chains, wood trimmer, creosote oil, etc., as advertised in The Engineering Record.

PROPOSALS OPEN

For Proposals see pages 77, 80, and 82

WATER WORKS.

Bids Close.		See Eng. Record.
Dec. 5.	Dam, Glendive, Mont. Adv. Sep. 16 to Oct. 21.	Sep. 16
Dec. 5.	Water wks., Perry, Fla. Adv. Nov. 25.	Nov. 25
Dec. 6.	System, Hammond, La.	Nov. 11
Dec. 6.	Intake pipe, Auburn, N. Y. Adv. Nov. 18 to Dec. 2.	Nov. 18
Dec. 6.	Tunnel, Buffalo, N. Y.	Dec. 2
Dec. 7.	Conduit, Salt Lake City, Utah	Dec. 2
Dec. 8.	Pipe, lead, etc., Panama Adv. Nov. 25 to Dec. 2.	Nov. 25
Dec. 9.	Mains, Lakewood, O.	Dec. 2
Dec. 11.	Water wks. improv., Nampa, Idaho	Nov. 18
Dec. 13.	Pipe, etc., Vancouver, B. C.	Nov. 18
Dec. 13.	Mains, etc., Long Island City, L. I., N. Y.	Dec. 2
Dec. 13.	Mains, etc., New York, N. Y.	Dec. 2
Dec. 13.	Pipe, etc., Brooklyn, N. Y.	Dec. 2
Dec. 14.	Sluice gates, etc., Richmond, Va.	Dec. 8
Dec. 15.	Canal work, Huntley, Mont. Adv. Oct. 21 to Dec. 2.	Oct. 21
Dec. 15.	Steel water tank, Lovington, Ill.	Nov. 25
Dec. 18.	Water wks., Abbeville, La.	Nov. 25
Dec. 18.	Pump engine, Cleveland O. Adv. Dec. 2.	Dec. 2
Dec. 20.	Water wks., Prescott, Wash.	Nov. 25
Dec. 20.	Pipe line, etc., San Diego, Cal.	Dec. 2
Dec. 21.	Mains, Muskogee, Ind. Ter. Adv. Dec. 2.	Dec. 2
Dec. 29.	Canal, etc., Klamath Falls, Ore. Adv. Nov. 4 to Dec. 2.	Nov. 4
Dec. 30.	Pumping engine, Washington, D. C. Adv. Dec. 2.	Dec. 2
Jan. 1.	Irrig. work, El Campo, Tex.	Oct. 7
Jan. 2.	**Water wks., Manila, P. I.**	**Sep. 30**
Feb. 1.	Water wks., Woodward, Okla. Ter.	Nov. 25
———	Franchise, Chattanooga, Tenn. Adv. Nov. 11	Nov. 11
———	Pump, etc., Valdosta, Ga.	Dec. 2

SEWERAGE AND SEWAGE DISPOSAL.

Dec. 5.	Chicago, Ill.	Dec. 2
Dec. 5.	Trenton, N. J.	Dec. 2
Dec. 6.	Chicago, Ill.	Nov. 18
Dec. 8.	Cincinnati, O.	Dec. 2
Dec. 11.	**Sheldon, Ia.**	**Oct. 14**
Dec. 11.	Nampa, Idaho.	Nov. 18
Dec. 11.	South Brooklyn, O.	Nov. 25
Dec. 11.	Syracuse, N. Y.	Dec. 2
Dec. 12.	Long Island City, L. I., N. Y.	Dec. 2
Dec. 12.	Cleveland, O.	Dec. 2
Dec. 13.	Brooklyn, N. Y.	Dec. 2
Dec. 16.	Boston, Mass.	Nov. 25
Dec. 18.	Abbeville, La.	Nov. 25
Dec. 18.	Petersburg, Va.	Dec. 2
Dec. 19.	Independence, Kan. Adv. Nov. 18.	Nov. 18
Dec. 20.	Bristol, Pa. Adv. Nov. 18 to 25.	Nov. 18
Dec. 21.	Muskogee, Ind. Ter. Adv. Dec. 2.	Dec. 2
Dec. 22.	Cincinnati, O.	Dec. 2
Dec. —.	Rockport, Ind.	Nov. 11
Jan. 12.	Manila, P. I.	Sep. 30
Feb. 1.	Woodlawn, Ala.	Oct. 28
Feb. 1.	Libertyville, Ill.	Nov. 25
Feb. 15.	Princeton, Ind.	Nov. 25
Feb. —.	Lake Forest, Ill.	Nov. 25
Feb. —.	Highland Park, Ill.	Nov. 25

BRIDGES.

Dec. 5.	Rockport, Ind.	Dec. 2
Dec. 6.	Atlantic City, N. J.	Nov. 25
Dec. 7.	New York, N. Y.	Dec. 2
Dec. 8.	Sioux Falls, S. D.	Nov. 25
Dec. 9.	New York, N. Y.	Dec. 2
Dec. 15.	Milwaukee, Wis.	Nov. 25
Dec. 27.	Norristown, Pa.	Dec. 2
Jan. 1.	Pensacola, Fla.	Sep. 30
Apr. 1.	West Fork, W. Va.	Dec. 2

PAVING AND ROADMAKING.

Dec. 5.	Brownstown, Ind.	Nov. 18
Dec. 6.	Paoli, Ind.	Nov. 25
Dec. 7.	New York, N. Y.	Dec. 2
Dec. 8.	Cincinnati, O.	Nov. 11
Dec. 8.	Live Oak, Fla.	Nov. 25
Dec. 9.	Princeton, Ind.	Dec. 2
Dec. 11.	Knox, Ind.	Dec. 2
Dec. 11.	Syracuse, N. Y.	Dec. 2
Dec. 12.	Cincinnati, O.	Nov. 25
Dec. 12.	New York, N. Y.	Dec. 2
Dec. 12.	Long Island City, L. I., N. Y.	Dec. 2
Dec. 12.	Shelbyville, Ind.	Dec. 2
Dec. 13.	Brooklyn, N. Y.	Dec. 2
Dec. 16.	Norwood, O.	Dec. 2
Dec. 18.	Kalamazoo, Mich.	Nov. 18
Dec. 18.	Sherman, Tex. Adv. Dec. 2.	Dec. 2
Dec. 19.	Cincinnati, O.	Dec. 2

POWER, GAS AND ELECTRICITY.

Dec. 5.	Washington, D. C.	Nov. 25
Dec. 5.	Philadelphia, Pa. Adv. Nov. 25.	Nov. 25
Dec. 5.	Appleton, Minn.	Nov. 25
Dec. 5.	Etna, Pa.	Dec. 2
Dec. 6.	Chicago, Ill.	Dec. 2
Dec. 7.	Sparta, Ga.	Nov. 25
Dec. 8.	Augusta, Ky. Adv. Dec. 2.	Dec. 2
Dec. 12.	Washington, D. C.	Dec. 2
Dec. 15.	Bowling Green, Mo.	Nov. 25
Dec. 18.	Gas plant, Winnipeg, Man. Adv. Nov. 18 to 25.	Nov. 18
Dec. 18.	Abbeville, La.	Nov. 25
Dec. 26.	Washington, D. C.	Dec. 2
Dec. 27.	**Lockport, Ill.**	**Nov. 4**
Jan. 5.	Washington, D. C. Adv. Dec. 2.	Dec. 2
Jan. 15.	Cincinnati, O.	Dec. 2
———	Franchise, Chattanooga, Tenn. Adv. Nov. 11.	Nov. 11
———	Bamberg, S. C.	Dec. 2
Apr. —.	Oakesdale, Wash.	Nov. 25

BUILDINGS.

Dec. 5.	Laundry, etc., Panama Adv. Nov. 25.	Nov. 25
Dec. 5.	Hospital, Paris, Tex.	Nov. 25
Dec. 5.	Pub Bldg., New York, N. Y.	Nov. 25
Dec. 5.	School, Moscow, Idaho.	Nov. 25
Dec. 6.	Plans for bus. bldg., Stockton, Cal.	Nov. 18
Dec. 6.	Pub. bldg., Baltimore, Md.	Nov. 18
Dec. 6.	School, Monticello, Ind.	Nov. 18
Dec. 6.	Pub. Bldg., Cleveland, O.	Nov. 25
Dec. 7.	School, Laurel, Miss.	Nov. 11
Dec. 7.	School, Mt. Pleasant, Mich.	Nov. 18
Dec. 7.	School, Buffalo, N. Y.	Dec. 2
Dec. 7.	Htg. college, New York, N. Y.	Dec. 2
Dec. 7.	Almshouse, Secaucus, N. J.	Dec. 2
Dec. 7.	Pub. bldg., New York, N. Y.	Dec. 2
Dec. 8.	Church, St. Elizabeth, Mo.	Nov. 18
Dec. 8.	Bus. bldgs., Montgomery, Ala.	Nov. 18
Dec. 11.	Univ. bldgs., Gainesville, Fla.	Nov. 25
Dec. 11.	Pub. bldg., New York, N. Y.	Dec. 2
Dec. 11.	School, New York, N. Y.	Dec. 2
Dec. 12.	Court house, Fairmount, Minn.	Nov. 18
Dec. 12.	Court house, New York, N. Y.	Dec. 2
Dec. 14.	School, Humboldt, Tenn.	Nov. 11
Dec. 14.	Church, New Prague, Minn.	Nov. 18
Dec. 15.	Pub. bldg., Ft. Meade, S. D.	Nov. 25
Dec. 15.	Bank, Conway, S. C.	Nov. 25
Dec. 15.	Hotel, Beaumont, Tex.	Dec. 2
Dec. 18.	Post bldgs., Ft. Leavenworth, Kan. Adv. Nov. 25 to Dec. 2.	Nov. 25
Dec. 20.	Pub. bldg., Annapolis, Md.	Nov. 18
Dec. 20.	School, Sanford, N. C.	Nov. 25
Dec. 20.	Pub. bldg., Washington, D. C. Adv. Dec. 2.	Dec. 2
Dec. 21.	Htg. Univ., Wilberforce, O.	Nov. 25
Dec. 22.	Hospital, Prescott, Ariz. Adv. Nov. 25 to Dec. 2.	Nov. 25
Dec. 22.	School improv., Toledo, O.	Dec. 2
Dec. 29.	School, Marquette, Mich.	Nov. 18
Dec. —	School, Bloomington, Ind.	**Oct. 21**
Jan. 1.	**Hotel, Davenport, Ia.**	**Sep. 30**
Jan. 1.	Jail, etc., Lillington, N. C.	Nov. 25
Jan. 2.	School, Riverside, Cal.	Dec. 2
Jan. 4.	Post Office, Natchitoches, La.	Nov. 18
Jan. 4.	Library for Univ., Bloomington, Ind. Adv. Nov. 25.	Nov. 25
Jan. 4.	School, Pawhuska, Okla. Ter.	Dec. 2
Jan. 5.	Htg. pub. bldg., Washington, D. C.	Dec. 2
Jan. 8.	Court house, Hillsboro, N. D.	Nov. 25
Jan. 10.	**Library plans, Toronto, Ont.**	**Sep. 23**
Jan. 10.	P. O. bldg., Reno, Nev. Adv. Nov. 18 to 25.	Nov. 18
Jan. —	**Hotel annex, Louisville, Ky.** Adv. Dec. 2.	**Nov. 4**
Jan. —.	Htg. college, Medford, Mass.	Dec. 2
Feb. 1.	Plans for armory, Hartford, Conn.	Nov. 18
Feb. —.	Hospital, Indianapolis, Ind.	Nov. 25
———	School, Chemawa, Ore.	Nov. 25
———	School Plans, Augusta, Ga.	Nov. 25

MISCELLANEOUS.

Dec. 4.	Park work, New York, N. Y.	Nov. 25
Dec. 5.	Supplies, Washington, D. C.	Nov. 11
Dec. 5.	Cement, etc., Guantanamo, Cuba	Nov. 18
Dec. 5.	Ditch, Ft. Dodge, Ia.	Nov. 18
Dec. 5.	Supplies, Wash, D. C.	Nov. 25
Dec. 5.	Fence, Troy, N. Y.	Dec. 2
Dec. 6.	Rip rap work, etc., New York, N. Y., Adv. Nov. 18 to Dec. 2.	Nov. 18
Dec. 6.	Engines, Atlantic City, N. J.	Nov. 25
Dec. 6.	Remov. of snow, Brooklyn, N. Y.	Nov. 25
Dec. 7.	Wharf, Ft. Moultrie, S. C. Adv. Nov. 11 to Dec. 2.	Nov. 11
Dec. 9.	Electric elevator, Norfolk, Va.	Nov. 11
Dec. 7.	Garbage plant, Ottawa, Ont.	Dec. 2
Dec. 10.	R. R. work, Brookville, Pa.	Nov. 25
Dec. 11.	Dredging, New York, N. Y. Adv. Nov. 25 to Dec. 2.	Nov. 25
Dec. 11.	Garbage disp. plant, Detroit, Mich.,	Dec. 2
Dec. 12.	Dam, Wheeling, W. Va. Adv. Nov. 11 to Dec. 2.	Nov. 11
Dec. 12.	Supplies, Washington, D. C.	Dec. 2
Dec. 12.	Stone, etc., New Brighton, S. I., N. Y.	Dec. 2
Dec. 12.	Ditch, etc., Houston, Tex.	Dec. 2
Dec. 15.	Telephone system, Huntley, Mont. Adv. Nov. 4 to Dec. 2.	Nov. 4
Dec. 15.	**R. R. franchise, Manila, P. I.**	**Nov. 4**
Dec. 18.	Wickets for dams, Pittsburg, Pa. Adv. Nov. 25 to Dec. 2.	Nov. 25
Dec. 18.	Metal work, Philadelphia, Pa. Adv. Nov. 25 to Dec. 2.	Nov. 25
Dec. 18.	Steam pumps, etc., Panama Adv. Dec. 2.	Dec. 2
Dec. 19.	Supplies, San Francisco, Cal.	Nov. 18
Dec. 22.	Dredging, Richmond, Va. Adv. Dec. 2.	Nov. 25
Dec. 26.	Supplies, Washington, D. C.	Dec. 2
Dec. 29.	Wharf, Ft. Monroe, Va.	Dec. 2
Jan. 1.	**Statue plans, Indianapolis, Ind.**	**Jul. 22**
Jan. 1.	R. R. work, Dubuque, Ia.	Nov. 11
Jan. 2.	R. R. work, Santiago, Chili	Nov. 25
Jan. 9.	**Wharf, etc., Auckland, N. Z.** Adv. Nov. 4 to Dec. 2.	**Oct. 14**
Jan. 9.	**Jetty work, etc., Auckland, N. Z.** Adv. Nov. 4 to Dec. 2.	**Nov. 4**
Jan. 15.	Excav. work, Buffalo, N. Y. Adv. Dec. 2.	Dec. 2
Apr. 2,	**'06. Harbor Work, Valparaiso, Chili,** Adv. Apr. 29 to Sep. 9.	**Apr. 29**
———	Ditch work, Pomona, Ill. Adv. Oct. 28 to Nov. 18.	Oct. 28
———	Fire alarm system, Seaforth, Ont. Adv. Nov. 25.	Nov. 25
———	Dredging, Nyack, N. Y. Adv. Nov. 25 to Dec. 2.	Nov. 25
———	Grading, Beaumont, Tex.	Dec. 2

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* *Items marked thus give the names of parties awarded contracts.*